United States
Department of
Agriculture

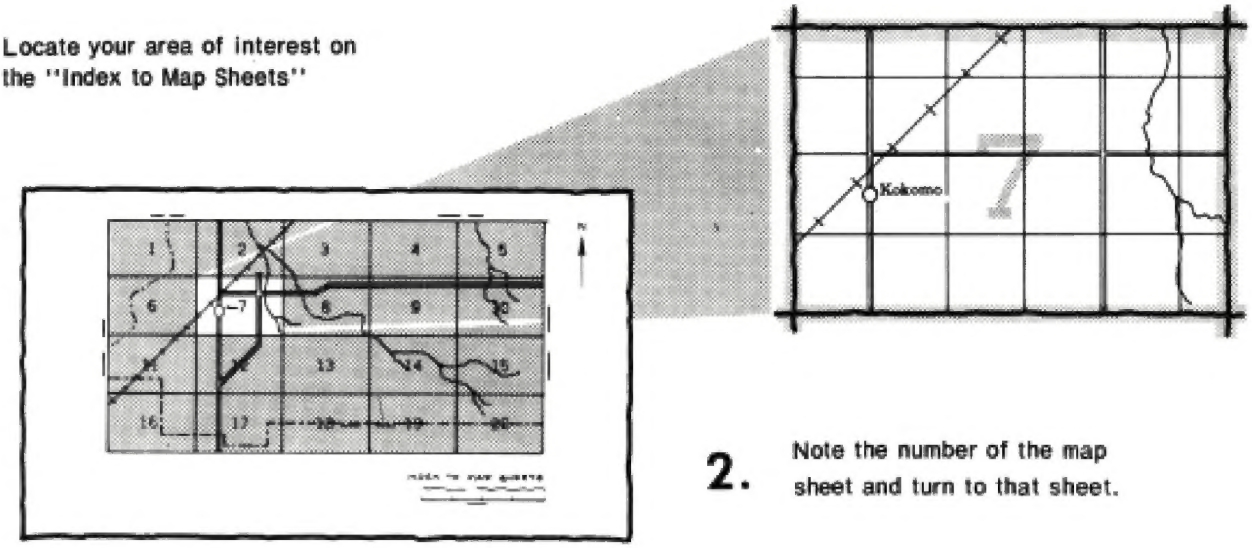
Soil
Conservation
Service

In cooperation with
The Agricultural Experiment
Station and the Cooperative
Extension Service of the
College of Agriculture
The Pennsylvania State
University; the Pennsylvania
Department of Environmental
Resources; and the
Pennsylvania Department
of Agriculture

Soil Survey of McKean County Pennsylvania

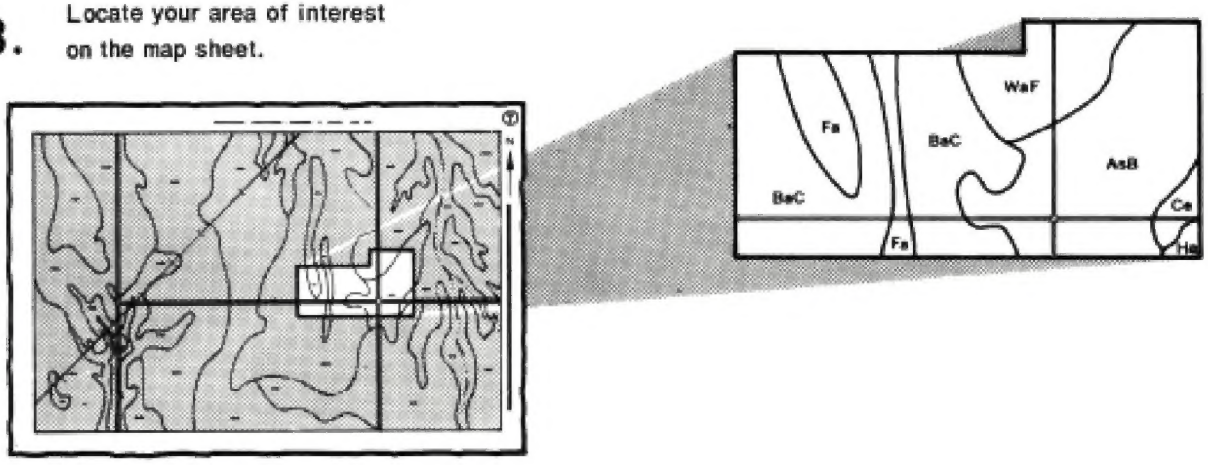
HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets"

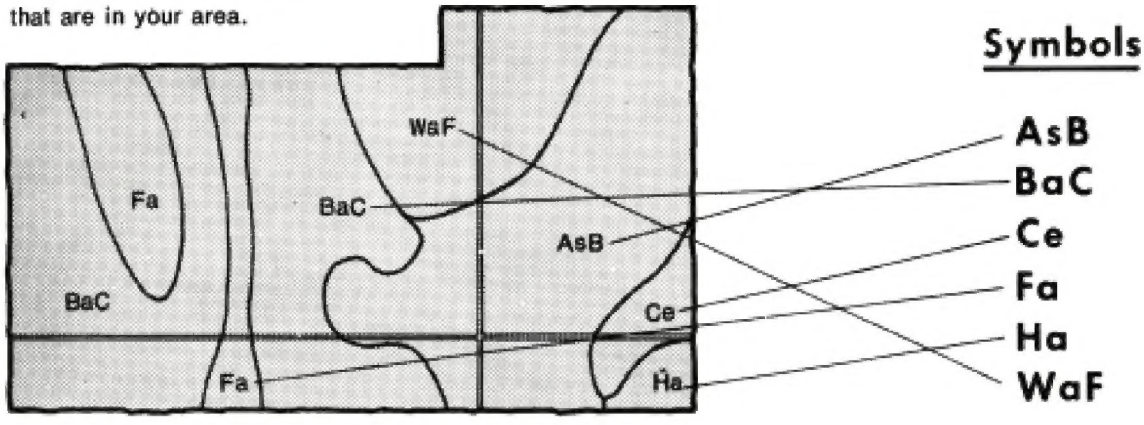


2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.

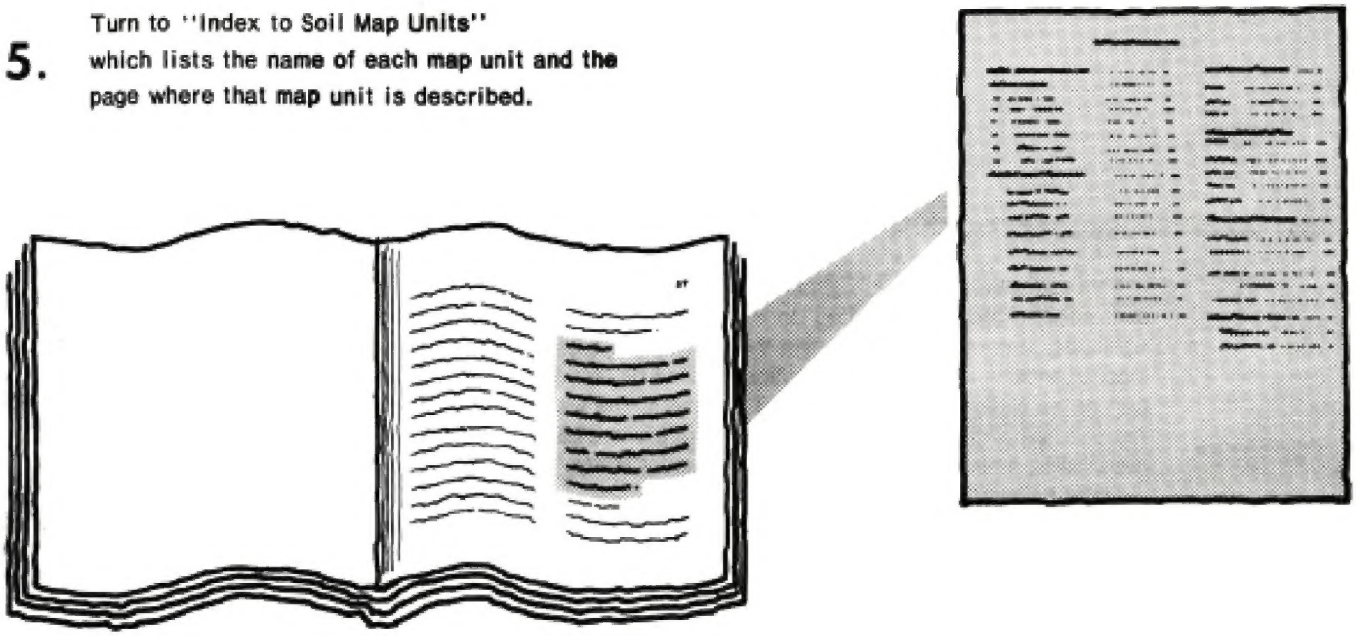


4. List the map unit symbols that are in your area.

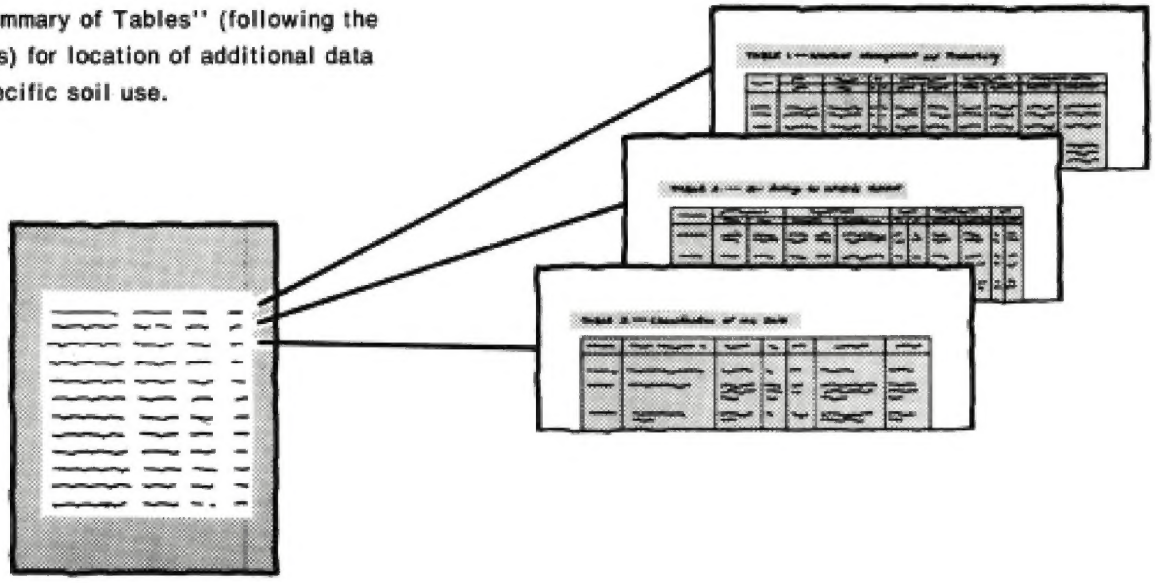


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1983. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This soil survey was made cooperatively by the Soil Conservation Service; the Agricultural Experiment Station and Cooperative Extension Service of the College of Agriculture, the Pennsylvania State University; the Pennsylvania Department of Agriculture. The U.S. Forest Service provided additional financial assistance to survey the soils in the Allegheny National Forest. This survey is part of the technical assistance furnished to the McKean County Conservation District. The survey is part of the technical assistance furnished to the McKean County Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: Cherry and maple trees on Clymer loam, 3 to 8 percent slopes. These trees make up the Allegheny hardwood forest type.

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Soil Series

Issued August 1987

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Summary of Tables

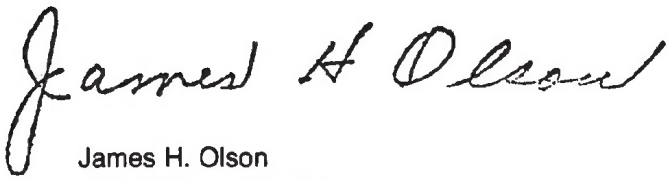
Foreword

This soil survey contains information that can be used in land-planning programs in McKean County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

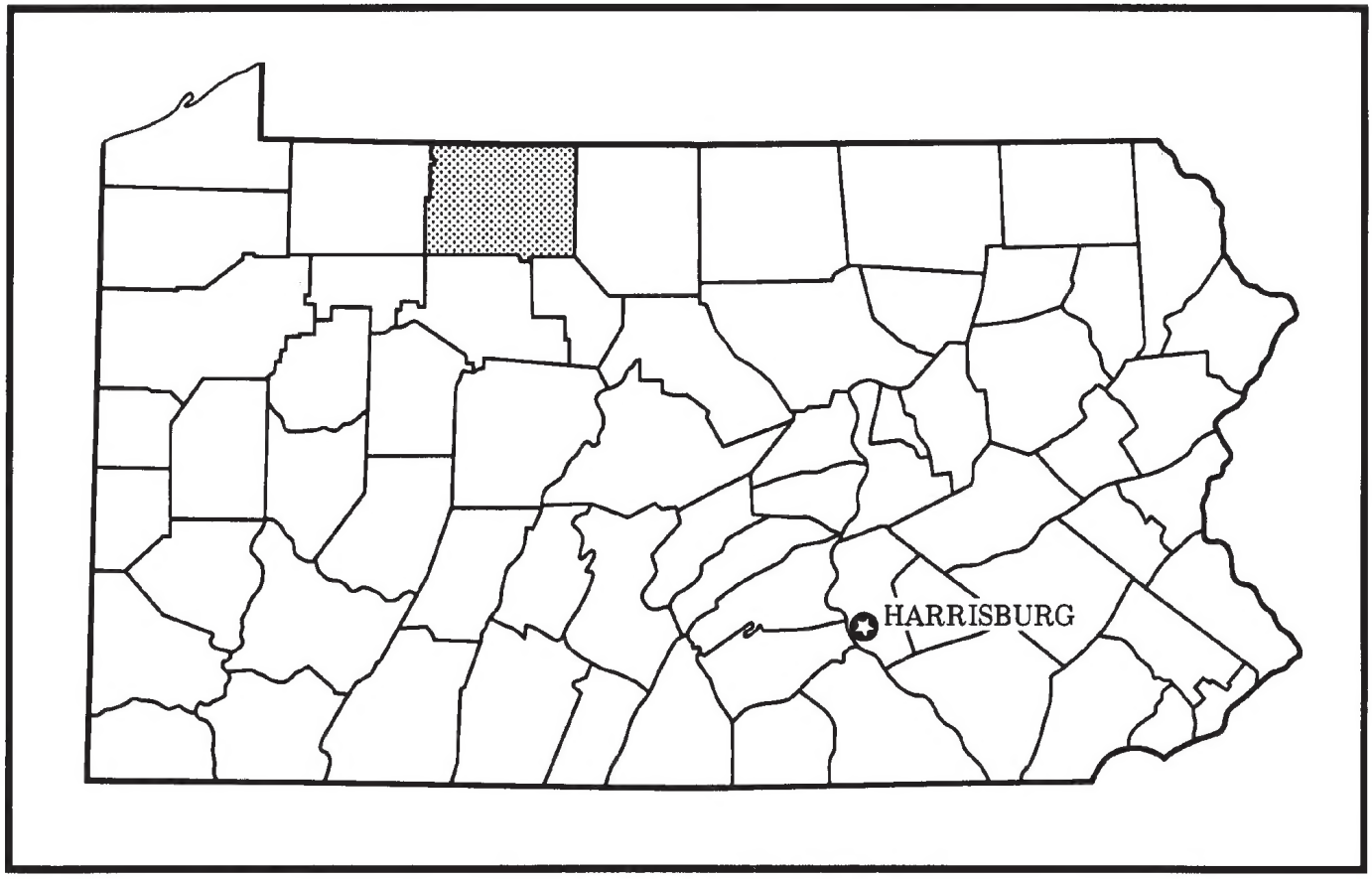
This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



James H. Olson
State Conservationist
Soil Conservation Service



Location of McKean County in Pennsylvania.

Soil Survey of McKean County, Pennsylvania

By Norman J. Churchill, Soil Conservation Service

Fieldwork by Norman J. Churchill and Paul H. Parrish,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the Agricultural Experiment Station and
the Cooperative Extension Service of the College of Agriculture,
The Pennsylvania State University;
the Pennsylvania Department of Environmental Resources; and
the Pennsylvania Department of Agriculture

McKEAN COUNTY is located in the north-central part of Pennsylvania. The county is bounded on the north by Cattaraugus and Allegany Counties, New York, and in Pennsylvania, on the east by Potter County, on the south by Cameron and Elk Counties, and on the west by Warren County. The county takes in 638,080 acres, or 997 square miles. It is approximately 27 miles north and south and 38 miles east and west. Elevations range from 2,460 feet on Prospect Hill to 1,280 feet at the point where Sinnemahoning Creek leaves the county, at Gardeau.

In 1980 the population of the county was 50,635. The population of Bradford, the largest community, was 11,211, and that of Smethport, the county seat, was 1,797. The other principal towns are Kane, Port Allegany, Eldred, and Mount Jewett.

Many industries are in the county. The main industries are manufacturing, oil production and refineries, and lumbering. The agriculture of the county consists mainly of dairy farms.

The area offers modern education, medical, cultural, and religious facilities. Transportation is by private vehicle, bus, and commuter airline. Rail transportation is provided by Conrail and the Baltimore and Ohio Railroad.

General Nature of the County

This section gives a brief description of the history, the resources, the climate, the geology, the water, and the transportation of the county.

History

McKean County was settled after the American Revolution (1775-83). Land companies were the major force in the early settlement. Most settlers came from New York and the eastern part of Pennsylvania by way of the upper reaches of the Allegheny River and the tributaries of the Susquehanna River. The first settlements were on the most fertile soils in the valleys, and settlement in this pattern continues today.

McKean County was formed from Lycoming County in 1804, and was named in honor of Pennsylvania Governor Thomas McKean.

Resources

Lumbering, the first major industry, is important today. The first successful oil well was drilled in 1871 (*3*). Oil and gas production is still very important. For nearly 50

years, until 1981, McKean County was the leading oil-producing county in Pennsylvania. In 1981, it was second to Warren County (*5*).

Coal in significant amounts was produced in the southern part of the county. Small flagstone quarries are operated in the eastern part of the county. Also, the local sandstone was used for building stone and in manufacturing glass. The local shale was used to make brick in the Kushequa and Lewis Run areas. Clay was mined in the Clermont and Hutchins areas to make tile and other products.

Climate

Prepared by the National Climatic Center, Asheville, North Carolina.

Winters are cold and snowy at the higher elevations in the county. In valleys it is also frequently cold, but intermittent thaws preclude a long-lasting snow cover. Summers are fairly warm on the mountain slopes. They are very warm and have occasional very hot days in the valleys. Rainfall is evenly distributed during the year, but it is appreciably heavier on the windward, west-facing slopes than in the valleys. Normal annual precipitation is adequate for all crops, although the summer temperature and the growing season length, particulary at the higher elevations, may be inadequate.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Bradford in the period 1957 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 21 degrees F, and the average daily minimum temperature is 13 degrees. The lowest temperature on record, which occurred at Bradford on Feb 11, 1979, is -30 degrees. In summer the average temperature is 63 degrees, and the average daily maximum temperature is 74 degrees. The highest recorded temperature, which occurred at Bradford on July 31, 1975, is 92 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 43 inches. Of this, 23 inches, or 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 4.91 inches on Sept 28, 1967. Thunderstorms occur on about 33 days each year, and most occur in summer.

The average seasonal snowfall is 84 inches. The greatest snow depth at any one time during the period of record was 44 inches. On the average, 82 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 60 percent of the time possible in summer and 40 percent in winter. The prevailing wind is from the west. Average windspeed is highest, 9 miles per hour, in spring.

Geology

About 300 million years ago, layers of sandy, silty, clayey, and limy sediments were laid down on this area of the continent in freshwater, inland seas. Organic material accumulated during various stages of this deposition. The elevation of the area was subsequently raised to or above its present elevation. The extreme pressure created during this uplifting and the weight of overlying sediments, over a long period of time, consolidated these layers into sandstone, siltstone, shale, limestone, and coal. This area became known as the Allegheny plateau physiographic province in Pennsylvania.

Millions of years of additional minor uplifting and subsiding, geologic erosion, and stream cutting changed the nearly level surface of much of the plateau to a highly dissected, rolling and hilly relief. Most of the county is hilly, but some parts, known locally as "the big level," are only slightly dissected.

Approximately 23,000 years ago, about a square mile of the northeastern corner of the county, north of Oswayo Creek, was covered by a major glacier. At that time, the Allegheny River, which drains most of the county, was blocked by ice. Consequently, many valleys were partly filled with the gravel, sand, and silt that washed from the surrounding hills. The soils that formed in these materials are dominantly in the Philo-Atkins-Basher and Albrights-Buchanan map units on the general soil map.

The bedrock formations in the county are nearly level, and very gently sloping synclines and anticlines trend southwest and northeast.

Rocks of Pennsylvanian age are the youngest in the county and underlie the highest elevations in the south and west. They belong to the Allegheny and Pottsville groups (*6*). They are primarily a cyclic sequence of shale, siltstone, sandstone, and, in the Allegheny group, some coal. The soils that formed in these materials are the Cookport-Hazleton map unit on the general soil map.

Rocks of Mississippian age are the second oldest in the county. They are in the Shenango and Oswayo Formations. These rocks are cyclic sequences of shale, siltstone, and sandstone and are mainly on the sides of valleys. The soils in these areas are dominantly in the Buchanan-Hartleton-Hazleton map unit on the general soil map.

Rocks of Devonian age are the oldest in the county. They are in the Catskill, Venango, and Chadakoin Formations. The Catskill Formation consists of red siltstone, shale, and sandstone. The soils in this area are dominantly in the Buchanan-Hartleton-Leck Kill map unit on the general soil map. The Venango Formation consists of gray siltstone, shale, and sandstone that has some interfingering of red shale from the Catskill Formation. The Chadakoin Formation consists of gray siltstone, sandstone, and shale. The soils on the Venango and Chadakoin Formations are dominantly in the Buchanan-Albrights map unit on the general soil map.

Water

McKean County lies almost entirely within the Ohio River drainage basin. It is drained mainly by the Allegheny River and its tributaries. A small area in the southeastern part is in the Susquehanna River drainage basin.

Stream pollution from mine drainage, sewage, and oil and gas production is a significant problem in the county. Many streams, however, are not polluted.

In general, the water supplies for the population of the county are sufficient. In some areas the ground water is polluted because of secondary recovery operations in oil fields. Many drilled wells yield water that is high in iron and thus is rated very hard. Many homes in the valleys rely on springs for a water supply (*4*).

Transportation

McKean County has a fairly extensive system of highways. The major roads are U.S. Routes 6 and 219 and Pennsylvania Route 59. Numerous other state routes and local roads are also within the county.

A commercial airport is at Mount Alton, and a private airstrip is south of Port Allegany. An interstate busline serves the county. Two railroads provide freight service in the county.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material has few or no roots or other living organisms and has been changed very little by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management

were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The boundaries of the map units on the general soil map of McKean County do not consistently match those of adjoining counties. These discrepancies exist because of legend design, changes in the concepts of individual series, and different counties. However, adjacent areas in the individual counties join similar kinds of soils.

Soil Descriptions

1. Buchanan-Hartleton-Leck Kill

Very deep and deep, somewhat poorly drained to well drained, moderately steep to very steep soils; formed in materials weathered from sandstone and shale; on uplands

This map unit consists of valley sides (fig. 1). It is mostly moderately steep, steep, and very steep, but includes some gently sloping and strongly sloping, narrow hilltops.

This map unit makes up 22 percent of the survey area. It is about 26 percent Buchanan soils, 25 percent Hartleton soils, 21 percent Leck Kill soils, and 28 percent minor soils (fig. 2).

Buchanan soils are moderately steep to very steep. Generally, they are on the lower side slopes and on foot slopes. They are very deep and moderately well drained to somewhat poorly drained. The subsoil is loamy.

Hartleton soils are steep and very steep. Generally, they are on the upper slopes. They are deep and well drained. The subsoil is loamy.

Leck Kill soils are steep and very steep. Generally, they are on the upper slopes. They are deep and well drained. The subsoil is loamy.

The minor soils are very deep, moderately well drained and somewhat poorly drained Albrights soils on foot slopes; very deep, poorly drained Brinkerton soils on foot slopes; very deep, poorly drained Atkins soils on flood plains; and very deep, well drained Meckesville soils on side slopes and foot slopes.

Nearly all the acreage of this map unit is forested. Most areas of this map unit are too steep for farming. Some areas on the more gently sloping foot slopes are farmed.

The major limitations for urban uses are slope and moderately slow permeability.

2. Cookport-Hazleton

Deep and very deep, moderately well drained and well drained, nearly level to moderately steep soils; formed in materials weathered from sandstone and shale; on uplands

This map unit consists of broad plateaus dissected by drainageways. It is mostly nearly level to moderately steep, but some areas are steep and very steep.

This map unit makes up 36 percent of the county. It is about 52 percent Cookport soils, 25 percent Hazleton soils, and 23 percent minor soils (fig. 3).

Cookport soils generally are on broad flats and on benches and hillsides. They are deep and very deep and moderately well drained. The subsoil is loamy.

Hazleton soils generally are on hilltops and hillsides. They are deep and well drained. The subsoil is loamy.

The minor soils are deep, moderately well drained Wharton soils on uplands, very deep, moderately well drained to somewhat poorly drained Buchanan soils along drainageways, and well drained Hartleton soils on hillsides.

Nearly all the acreage of this map unit is forested. Some areas are farmed and used as sites for homes and hunting camps. Most cleared areas are suited to farming and to use as woodland.

The major limitations for urban uses are the seasonal high water table in winter and spring and depth to bedrock.

Figure 1.—Typical area of Buchanan, Hartleton, and Leck Kill soils. Buchanan soils are on the lower slopes, and Hartleton and Leck Kill soils are on the steeper slopes.

3. Buchanan-Hartleton-Hazleton

Very deep and deep, somewhat poorly drained to well drained, nearly level to very steep soils; formed in materials weathered from sandstone and shale; on uplands

This map unit consists of small valleys and narrow ridges (fig. 4). It is mostly steep and very steep, but includes some gently sloping hilltops and nearly level valleys.

This map unit makes up 31 percent of the survey area. It is about 43 percent Buchanan soils, 28 percent Hartleton soils, 10 percent Hazleton soils, and 19 percent minor soils.

Buchanan soils are nearly level to very steep. Generally, they are on the lower slopes. They are very deep and moderately well drained and somewhat poorly drained. The subsoil is loamy.

Hartleton soils are nearly level to very steep. Generally, they are on the upper slopes and on ridgetops. They are deep and well drained. The subsoil is loamy.

Hazleton soils are nearly level to moderately steep. Generally, they are on the upper slopes and on

ridgetops. They are deep and well drained. The subsoil is loamy.

The minor soils are very deep, poorly drained Atkins soils on flood plains and deep, somewhat poorly drained Cavode soils on benches.

About 80 percent of the acreage of this map unit is forested. The rest has been cleared and is reverting to brushland and woodland. Most areas of this map unit are too stony or steep for cultivated crops.

The major limitations for urban uses are the seasonal high water table in winter and spring and slope.

4. Albrights-Buchanan

Very deep, moderately well drained and somewhat poorly drained, nearly level to moderately steep soils; formed in materials weathered from sandstone and shale; on uplands

This map unit consists of toe slopes along secondary streams and the headwaters of major streams. It is mostly strongly sloping and gently sloping, and includes nearly level and moderately steep areas.

This map unit makes up 8 percent of the county. It is about 47 percent Albrights soils, 35 percent Buchanan soils, and 18 percent minor soils.

Albrights soils are nearly level to strongly sloping. They are in the low positions on the landscape. The subsoil is loamy.

Buchanan soils are nearly level to moderately steep. They are in the higher positions on the landscape or are farther from the streams than Albrights soils. The subsoil is loamy.

The minor soils are very deep, poorly drained Brinkerton soils on the lower slopes, very deep, poorly drained Atkins soils on flood plains, and very deep, well drained Meckesville soils on the upper slopes.

Much of the acreage of this map unit is farmed. The major limitations for farming are the seasonal high water table in winter and spring and slow permeability. The

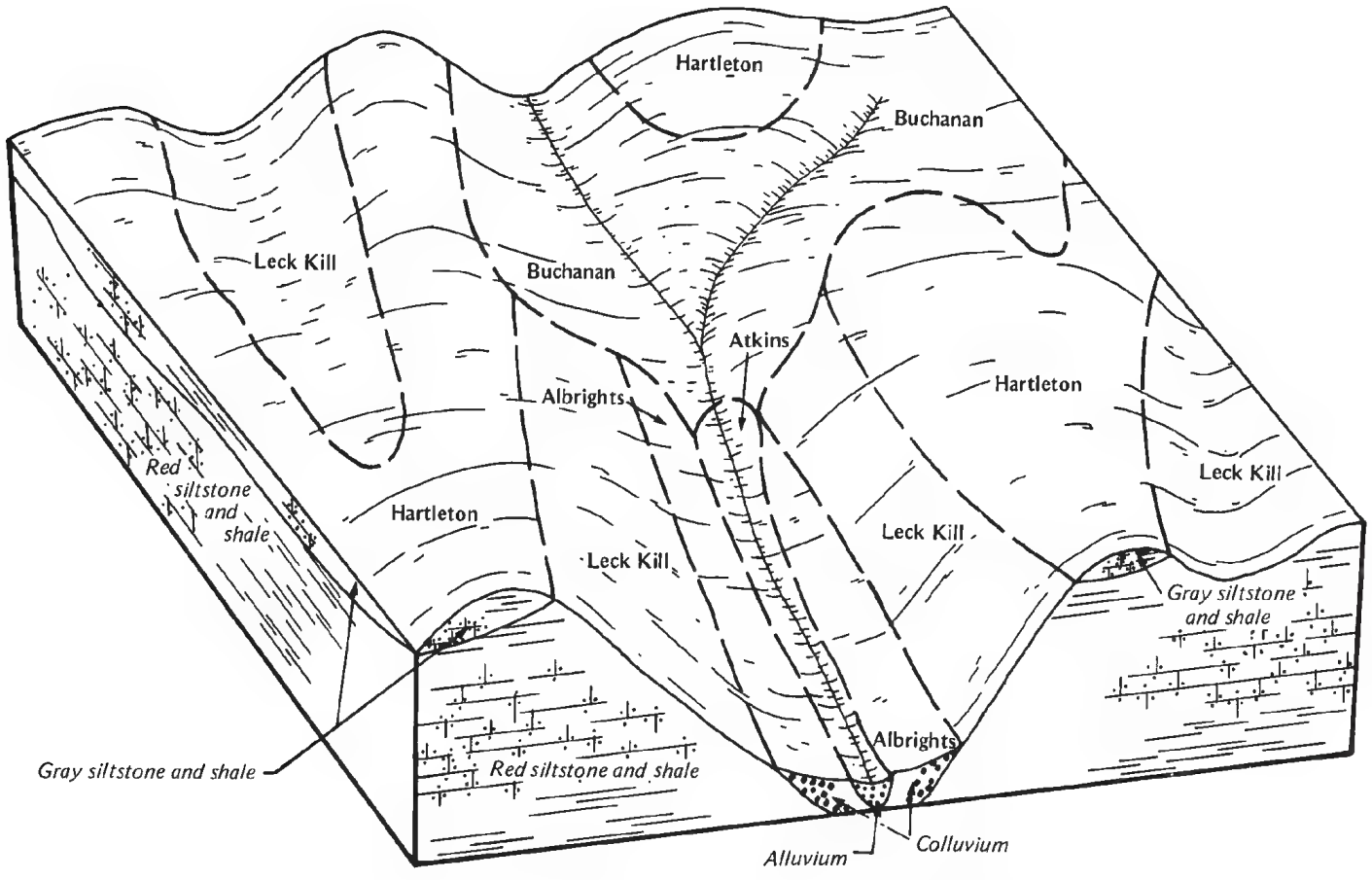


Figure 2.—Typical landscape pattern of the soils and the underlying material in the Buchanan-Hartleton-Leck Kill general soil map unit.

major limitations for urban uses are the seasonal high water table in winter and spring and slow permeability.

5. Philo-Atkins-Basher

Very deep, poorly drained to well drained, nearly level soils; formed in water-deposited materials derived from sandstone and shale; on flood plains

This map unit is in valleys, mainly in the northern part of the county adjacent to major streams. It is on flood plains.

This map unit makes up 3 percent of the county. It is about 37 percent Philo soils, 21 percent Atkins soils, 16 percent Basher soils, and 26 percent minor soils.

Philo soils are moderately well drained. The subsoil is loamy.

Atkins soils are poorly drained. The subsoil is loamy.

Basher soils are moderately well drained and somewhat poorly drained. The subsoil is loamy.

The minor soils are very deep, well drained Barbour and Pope soils on flood plains and very deep, well drained Chenango soils, very deep, moderately well drained to somewhat poorly drained Braceville soils, and very deep, somewhat poorly drained to poorly drained Rexford soils on terraces.

Most areas of this map unit are farmed or used for urban and industrial uses. Flooding is common in the lower lying areas. These areas are farmed, unless they are protected by engineering measures. The wettest areas are in forest or brushland. The major limitations for farming are flooding, the seasonal high water table in winter and spring, and slow permeability.

The major limitations for urban uses are flooding, the seasonal high water table in winter and spring, and slow permeability.

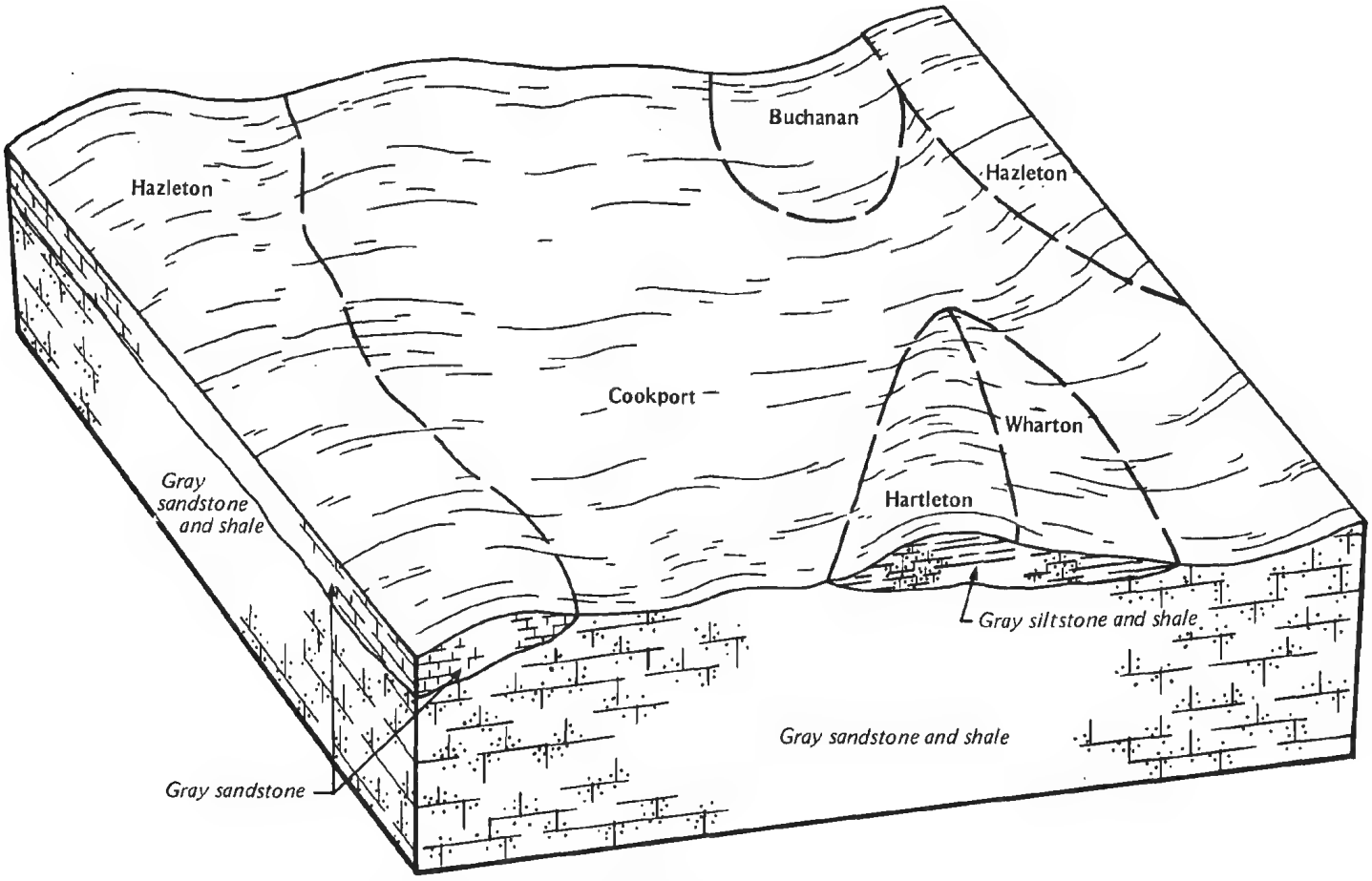


Figure 3.—Typical landscape pattern of the soils and the underlying material in the Cookport-Hazleton general soil map unit.

Figure 4.—Typical area of Buchanan, Hartleton, and Hazleton soils. Buchanan soils are on the lower slopes (foreground and middle ground), and Hartleton and Hazleton soils are on ridges and the steep side slopes (background).

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases.* Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Cookport loam, 3 to 8 percent slopes, is one of several phases in the Cookport series.

One map unit is made up of two major soils. This map unit called an undifferentiated group.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in the mapped areas are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Hartleton and Buchanan soils, 25 to 60 percent slopes, is an undifferentiated group in this survey area.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Some of the boundaries of the detailed soil maps in McKean County do not match those in earlier surveys because of changes in the concept of some series, differing soil patterns observed between adjacent counties, and differing degrees of soil separation.

Soil Descriptions

AbB—Albrights silt loam, 3 to 8 percent slopes. This is a gently sloping, very deep, moderately well drained and somewhat poorly drained soil in broad valleys and drainageways. Slopes are smooth and concave and are generally 200 to 300 feet long. Areas are generally elongated in shape and range from about 5 to 20 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 48 inches. In the upper part, to a depth of 19 inches, it is reddish brown silt loam. The lower part, to a depth of 48 inches, is a firm and brittle layer of mottled, reddish brown loam called a fragipan. The substratum is reddish brown channery clay loam to a depth of 70 inches or more.

Included with this soil in mapping are small areas of very deep, well drained Meckesville soils and very deep, poorly drained Brinkerton soils. Also included are some areas of very stony Albrights soils. The included soils make up about 15 percent of the map unit.

Permeability of this Albrights soil is moderate above the fragipan and moderately slow in the fragipan. Available water capacity is low or very low. Runoff is medium. Rooting depth is restricted by the fragipan at a depth of about 18 to 30 inches. The seasonal high water table is at a depth of about 12 to 30 inches in winter and spring. In unlimed areas the soil is extremely acid to strongly acid in the surface layer and the upper part of the subsoil and very strongly acid to moderately acid in

the lower part of the subsoil and in the substratum. Erosion is a moderate hazard.

Most areas of this soil are in cultivated crops (fig. 5). Some areas are used for permanent pasture or are idle. A few areas are in nonfarm uses. A few areas are woodland.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. In some wet areas surface and subsurface drainage is needed to allow timely tillage.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is too wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity. Laying out roads on the contour helps to control erosion.

The seasonal high water table and moderately slow permeability in the fragipan are limitations to use of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. If the soil is used for onsite waste disposal, specially designed systems are needed. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIe; the woodland ordination symbol is 4A.

AbC—Albrights silt loam, 8 to 15 percent slopes. This is a sloping, very deep, moderately well drained and somewhat poorly drained soil on foot slopes of valleys and in the heads of drainageways. Slopes are smooth and concave and are generally 200 to 300 feet long.

Figure 5.—An area of Albrights silt loam, 3 to 8 percent slopes, in crops (foreground). Hartleton and Buchanan soils, 25 to 60 percent slopes, are on the steeper slopes (background).

Areas are generally elongated in shape and range from about 5 to 20 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 48 inches. In the upper part, to a depth of 19 inches, it is reddish brown silt loam. In the lower part, to a depth of 48 inches, it is a firm and brittle layer of mottled, reddish brown loam called a fragipan. The substratum is reddish brown channery clay loam to a depth of 70 inches or more.

Included with this soil in mapping are small areas of very deep, moderately well drained and somewhat poorly drained Buchanan soils, very deep, well drained Meckesville soils, and deep, well drained Leck Kill soils. The included soils make up about 15 percent of the map unit.

Permeability of this Albrights soil is moderate above the fragipan and moderately slow in the fragipan. Available water capacity is low or very low. Runoff is moderately rapid. Rooting depth is restricted by the fragipan at a depth of about 18 to 30 inches. The seasonal high water table is at a depth of about 12 to 30 inches in winter and spring. In unlimed areas the soil is extremely acid in the surface layer and the upper part of the subsoil and very strongly acid to moderately acid in the lower part of the subsoil and in the substratum. Erosion is a severe hazard.

Most areas of this soil are in cultivated crops. Some areas are used for permanent pasture or are idle. A few areas are in nonfarm uses. A few areas are woodland.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. In some wet areas surface and subsurface drainage is needed to allow timely tillage.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is too wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees and potential productivity for northern red oak on this soil is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table, moderately slow permeability in the fragipan, and slope are serious limitations of this soil for most urban uses. If the soil is used for onsite waste disposal, specially designed systems are needed. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIIe; the woodland ordination symbol is 4A.

AdC—Albrights silt loam, 8 to 15 percent slopes, very stony. This is a sloping, very deep, moderately well drained and somewhat poorly drained soil on foot slopes and in the heads of drainageways. Slopes are smooth and concave and are generally 200 to 300 feet long. Most areas are elongated in shape and range from 5 to 50 acres. Large stones cover 3 to 15 percent of the surface.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 48 inches. The upper 11 inches is reddish brown silt loam. The lower 29 inches is a firm and brittle layer of mottled, reddish brown loam called a fragipan. The substratum is reddish brown channery clay loam to a depth of 70 inches or more.

Included with this soil in mapping are small areas of very deep, moderately well drained to somewhat poorly drained Buchanan soils. Also included are some areas of soils where less than 3 percent of the surface is covered with stones. The included soils make up about 15 percent of the map unit.

Permeability of the Albrights soil is moderate above the fragipan and moderately slow in the fragipan. Available water capacity is low or very low. Runoff is medium. Rooting depth is restricted by the fragipan at a depth of about 18 to 30 inches. The seasonal high water table is at a depth of about 12 to 30 inches in winter and spring. In unlimed areas the soil is extremely acid in the surface layer and the upper part of the subsoil and very strongly acid to moderately acid in the lower part of the subsoil and in the substratum. Erosion is a moderate hazard.

Most areas of this soil are woodland.

This soil is poorly suited to cultivated crops or to improved pasture because of the stones on the surface. It is not feasible to remove the trees and surface stones for cultivated crops or improved pasture.

This soil is well suited to trees. Potential productivity for northern red oak on this soil is moderately high. Machine planting is generally not practical because of the stones on the surface. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table, moderately slow permeability in the fragipan, and slope are limitations to use of this soil as sites for most urban uses. If the soil is used for onsite waste disposal, specially designed systems are needed. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass VIs; the woodland ordination symbol is 4A.

At—Atkins silt loam. This is a nearly level, very deep, poorly drained soil on flood plains (fig. 6). Areas are generally long and narrow in shape and range from 5 to about 15 acres. Slopes range from 0 to 3 percent.

Figure 6.—An area of Atkins silt loam, which is poorly drained, on a flood plain (foreground). Hartleton and Buchanan soils are on the steeper slopes (background).

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil extends to a depth of 35 inches. In the upper part, to a depth of 14 inches, it is mottled, dark gray silt loam. In the lower part, to a depth of 35 inches, it is mottled, dark gray loam. The substratum is gray gravelly sandy loam to a depth of 65 inches or more.

Included with this soil in mapping are small areas of very deep, moderately well drained Philo soils, very deep, moderately well drained and somewhat poorly drained Basher soils, and very deep, very poorly drained Palms soils. The included soils make up about 15 percent of the map unit.

Permeability of this Atkins soil is slow to moderate in the upper part of the subsoil and slow to rapid in the lower part of the subsoil. Available water capacity is moderate to high. Runoff is slow. Flooding is frequent. The seasonal high water table is between the surface and a depth of 12 inches in winter and spring. In unlimed areas the soil is strongly acid or very strongly acid. Erosion is a slight hazard.

Most areas of this soil are used for permanent pasture or are woodland. Some areas are in cultivated crops. A few areas are in nonfarm uses.

This soil is suited to cultivated crops. However, flooding frequently delays planting and sometimes causes crop damage. In some wet areas surface and subsurface drains are needed to allow timely tillage. Cover crops help to control scouring by floodwater.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is too wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for red maple is moderate. Machine planting is usually practical in the large areas. Thinning and removing undesirable species help to increase productivity. The seasonal high water table impedes the use of equipment for long periods. Where feasible, building main haul roads on better drained soils allows the use of equipment.

The seasonal high water table and flooding are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements.

This soil is in capability subclass IIIw; the woodland ordination symbol is 4W.

Ba—Barbour loam. This is a nearly level, very deep, well drained soil on flood plains. Areas are generally long and narrow in shape and range from about 5 to 15 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark reddish brown loam about 7 inches thick. The subsoil is reddish brown loam to a depth of 21 inches. The substratum is reddish brown gravelly loam to a depth of 29 inches and reddish brown very gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, moderately well drained Basher soils and very deep, poorly drained Atkins soils. The included soils make up about 15 percent of the map unit.

Permeability of this Barbour soil is moderately rapid in the surface layer and the subsoil and rapid in the substratum. Available water capacity is moderate or high. Runoff is slow. Flooding is occasional. In unlimed areas the soil is moderately acid to very strongly acid in the surface layer and the subsoil and slightly acid to strongly acid in the substratum. Erosion is a slight hazard.

Most areas of this soil are used for cultivated crops, hay, and pasture. Some areas are wooded.

This soil is suited to cultivated crops, but in some years flooding delays planting. Cover crops help to control scouring by floodwater.

This soil is suited to pasture. The major concern in pasture management is overgrazing. Stocking rates within carrying capacity, deferred grazing, and rotation grazing are suitable management practices.

This soil is suited to trees, and potential productivity for sugar maple is moderate. Flooding impedes the use of equipment for short periods. Machine planting is generally practical.

Flooding is a limitation of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements.

This soil is in capability subclass I; the woodland ordination symbol is 3A.

Bb—Basher silt loam. This is a nearly level, very deep, moderately well drained and somewhat poorly drained soil on flood plains. Areas are generally long and narrow in shape and range from about 5 to 50 acres. Slopes range from 0 to 3 percent.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is brown silt loam to a depth of 20 inches. The substratum is brown fine sandy loam to a depth of 41 inches and brown very gravelly loamy sand to a depth of 73 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, well drained Barbour soils and very deep, poorly drained Atkins soils. The included soils make up about 15 percent of the map unit.

Permeability of this Basher soil is moderate or moderately slow in the surface layer and the subsoil and moderate or moderately rapid in the substratum. Available water capacity is moderate or high. Runoff is slow. The seasonal high water table is at a depth of 6 to 24 inches in winter and spring. Flooding is occasional. In unlimed areas the soil ranges from moderately acid to very strongly acid above a depth of 41 inches and from very strongly acid to slightly acid below that depth. Erosion is a slight hazard.

Most areas of this soil are used for cultivated crops, hay, and pasture. Some areas are wooded.

This soil is suited to cultivated crops, but in some years flooding delays planting or damages crops. Cover crops help to control scouring by floodwater.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is too wet. Stocking rates within carrying capacity, deferred grazing, rotation grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for sugar maple is moderate. Flooding impedes the use of equipment, but only for short periods. Machine planting is generally practical.

Flooding and the seasonal high water table are limitations of this soil for most urban uses, including onsite waste disposal and sites for dwellings with basements.

This soil is in capability subclass IIw; the woodland ordination symbol is 3A.

BeB—Braceville silt loam, 3 to 8 percent slopes. This is a gently sloping, very deep, moderately well drained and somewhat poorly drained soil on stream terraces. Slopes are smooth and slightly concave and generally are 50 to 150 feet long. Areas are generally triangular or elongated oval in shape and range from about 50 to 200 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 7 inches thick. The subsoil extends to a depth of 37 inches. In the upper part, to a depth of 18 inches, it is yellowish brown and brown silt loam. In the lower part, to a depth of 37 inches, it is a firm and brittle layer of mottled, yellowish brown gravelly silt loam called a fragipan. The substratum is yellowish brown extremely gravelly loamy sand to a depth of 63 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, well drained Chenango soils and very deep, somewhat poorly drained Rexford soils. The included soils make up about 10 percent of the map unit.

Permeability of this Braceville soil moderately above the fragipan, slow to moderately slow in the fragipan, and moderately rapid to rapid in the substratum.

Available water capacity is very low or low. Runoff is slow. Rooting depth is restricted by the fragipan at a depth of 15 to 36 inches. The seasonal high water table is at a depth of about 12 to 30 inches in winter and spring. In unlimed areas, the soil ranges from very strongly acid to moderately acid above the fragipan and from strongly acid to slightly acid in the fragipan and in the substratum. Erosion is a moderate hazard.

Most areas of this soil are used for cultivated crops, hay, and pasture. Some areas are wooded.

This soil is suited to cultivated crops, but erosion is a moderate hazard. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. In some wet areas surface and subsurface drainage is needed to allow timely tillage.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is well suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is generally practical in large areas. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table and moderately slow or slow permeability in the fragipan are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. If the soil is used for onsite waste disposal, specially designed systems are needed to help prevent ground water contamination. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIw; the woodland ordination symbol is 4A.

BrA—Brinkerton silt loam, 0 to 3 percent slopes. This is a nearly level, very deep, poorly drained soil in drainageways, near heads of streams, and on broad, upland basins. Slopes are smooth and range from 25 to 100 feet. Areas are irregular in shape and range from about 5 to 30 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 44 inches. In the upper part, to a depth of 20 inches, it is mottled, grayish brown and gray silty clay loam. In the lower part, to a depth of 44 inches, it is a firm and brittle layer of mottled, gray silt loam called a fragipan. The substratum is mottled, light brownish gray silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, poorly drained Atkins soils and deep, moderately well drained Cookport soils. Also included are a few areas of very poorly drained soils. The included soils make up about 15 percent of the map unit.

Permeability of this Brinkerton soil is moderate above the fragipan and slow or moderately slow in the fragipan and in the substratum. Available water capacity is low or moderate. Runoff is very slow, and the surface is ponded some of the time. The seasonal high water table is between the surface and a depth of 6 inches in winter and spring. Rooting depth is restricted by the fragipan at a depth of 16 to 28 inches. The soil ranges from very strongly acid to moderately acid in the surface layer and the subsoil and from strongly acid to slightly acid in the substratum. Erosion is a slight hazard.

Most areas of this soil are woodland or idle. Some areas are used for pasture (fig. 7).

This soil is suited to cultivated crops. The main limitation is the seasonal high water table. If the soil is used for cultivated crops, excess water causes the soil to warm slowly in spring, and thus delays planting. In some years surface ponding damages crops. Excess water can be removed by keeping open natural drainageways and by installing surface and subsurface drainage where suitable outlets are available.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, when the soil is wet, restricted grazing are suitable management practices.

This soil is suited to trees, and productivity for northern red oak is moderately high. Thinning and removing undesirable species help to increase productivity. The seasonal high water table impedes the use of equipment for long periods. Where feasible, building main haul roads on adjacent, drier soils allows the use of equipment.

The seasonal high water table and slow or moderately slow permeability in the fragipan and in the substratum are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Locating onsite waste disposal systems on adjacent, better drained soils is a suitable management practice. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IVw; the woodland ordination symbol is 4W.

BrB—Brinkerton silt loam, 3 to 8 percent slopes. This is a gently sloping, very deep, poorly drained soil on foot slopes, in drainageways, and near the heads of streams. Slopes are smooth and concave and generally range from 50 to 200 feet in length. Areas are irregular in shape and range from about 5 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 44 inches. In the upper part, to a depth of 20 inches, it is mottled, grayish brown and gray silty clay

Figure 7.—Brinkerton silt loam, 0 to 3 percent slopes, (foreground) is poorly drained, and Cookport loam, 3 to 8 percent slopes, (background) is moderately well drained. The soils are suited to pasture.

loam. In the lower part, to a depth of 44 inches, it is a firm and brittle layer of mottled, gray silt loam called a fragipan. The substratum is mottled, light brownish gray silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, poorly drained Atkins soils, very deep, moderately well drained and somewhat poorly drained Albrights soils, and very deep, moderately well drained Buchanan soils. The included soils make up about 15 percent of the map unit.

Permeability of this Brinkerton soil is moderate above the fragipan and slow or moderately slow in the fragipan and in the substratum. Available water capacity is low or moderate. Runoff is slow. The seasonal high water table is between the surface and a depth of 6 inches in winter and spring. Rooting depth is restricted by the fragipan at a depth of 16 to 28 inches. The soil ranges from very strongly acid to moderately acid in the surface layer and the subsoil and from strongly acid to slightly acid in the substratum.

Most areas of this soil are woodland or idle. Some areas are used for pasture.

This soil is suited to cultivated crops. The main limitation is the seasonal high water table. Stripcropping,

conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. If the soil is used for cultivated crops, excess water causes the soil to warm slowly in spring, and thus delays planting. Excess water can be drained by keeping open natural drainageways and by installing open drains and tile drains where suitable outlets are available.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, when the soil is wet, restricted grazing are suitable management practices.

This soil is suited to trees, and productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity. Laying out roads on the contour helps to control erosion. The seasonal high water table impedes the use of machinery for long periods. Where feasible, building main haul roads on adjacent, drier soils allows the use of equipment.

The seasonal high water table and slow or moderately slow permeability in the fragipan and in the substratum are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Locating onsite waste disposal systems on adjacent, better drained soils is a suitable management practice. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IVw; the woodland ordination symbol is 4W.

BsB—Brinkerton silt loam, 0 to 8 percent slopes, very stony. This is a nearly level and gently sloping, very deep, poorly drained soil on foot slopes, in drainageways, and near the heads of streams. Slopes are smooth and concave and generally range from 100 to 300 feet in length. Areas are irregular in shape and range from 5 to 50 acres. Large stones cover 3 to 15 percent of the surface.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 44 inches. In the upper part, to a depth of 20 inches, it is mottled, grayish brown and gray silty clay loam. In the lower part, to a depth of 44 inches, it is a firm and brittle layer of mottled, gray silt loam called a fragipan. The substratum is mottled, light brownish gray silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, poorly drained Atkins soils, very deep, very poorly drained soils, and very deep, moderately well drained Buchanan soils. The included soils make up about 15 percent of the map unit.

Permeability of this Brinkerton soil is moderate above the fragipan and slow or moderately slow in the fragipan and in the substratum. Available water capacity is low or moderate. Runoff is slow. The seasonal high water table is between the surface and a depth of 6 inches in winter and spring. Rooting depth is restricted by the fragipan at a depth of 16 to 28 inches. The soil ranges from very strongly acid to moderately acid in the surface layer and the subsoil and from strongly acid to slightly acid in the substratum.

Most areas of this soil are woodland. The soil is not suited to cultivated crops and poorly suited to improved pasture because of numerous stones on the surface.

This soil is suited to trees, and productivity for northern red oak is moderately high. The seasonal high water table impedes the use of equipment for long periods. Where feasible, building main haul roads on adjacent, drier soils allows the use of equipment. Thinning and removing undesirable species increases productivity. Laying out roads on the contour helps to control erosion.

The seasonal high water table and slow or moderately slow permeability in the fragipan and in the substratum are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Locating onsite waste disposal systems on adjacent, better drained soils is a suitable management practice. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass VIs; the woodland ordination symbol is 4W.

BuB—Buchanan silt loam, 3 to 8 percent slopes. This is a gently sloping, very deep, moderately well drained and somewhat poorly drained soil in broad valleys and in drainageways. Slopes are smooth and concave and are generally 200 to 300 feet long. Areas are generally elongated in shape and range from about 5 to 20 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 43 inches. It is mottled, yellowish brown silt loam to a depth of 13 inches and mottled, yellowish brown clay loam to a depth of 26 inches. Below that, to a depth of 43 inches, it is a firm and brittle layer called a fragipan. The fragipan is mottled, brown gravelly clay loam to a depth of 37 inches and mottled, dark brown gravelly clay loam to a depth of 43 inches. The substratum is mottled, dark brown gravelly silt loam to a depth of 83 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, moderately well drained and somewhat poorly drained Albrights soils and very deep, poorly drained Brinkerton soils. The included soils make up about 10 percent of the map unit.

Permeability of this Buchanan soil is moderate above the fragipan and slow in the fragipan and the substratum. Available water capacity is low or moderate. Runoff is medium. Rooting depth is restricted by the fragipan at a depth at about 20 to 36 inches. The seasonal high water

Figure 8.—Typical area of Albrights and Buchanan soils. Albrights soils are in cultivated crops (middle ground), and Buchanan soils are planted with corn (foreground).

table is at a depth of about 18 to 36 inches in winter and spring. In unlimed areas the soil is extremely acid to moderately acid. Erosion is a moderate hazard.

Most areas of this soil are woodland. Some areas are used for cultivated crops, hay, and pasture (fig. 8). A few areas are in urban use.

This soil is suited to cultivated crops. Erosion is a moderate hazard. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. In some wet areas surface and subsurface drainage is needed to allow timely tillage.

This soil is fairly suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is too wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table and slow permeability in the fragipan and the substratum are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIe; the woodland ordination symbol is 4A.

BuC—Buchanan silt loam, 8 to 15 percent slopes. This is a sloping, very deep, moderately well drained and somewhat poorly drained soil on foot slopes and in the heads of drainageways. Slopes are smooth and concave and generally are 200 to 300 feet long. Areas are generally elongated in shape and range from about 5 to 20 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of

43 inches. It is mottled, yellowish brown silt loam to a depth of 13 inches and mottled, yellowish brown clay loam to a depth of 37 inches. Below that, to a depth of 43 inches, it is a firm and brittle layer called a fragipan. The fragipan is mottled, brown gravelly clay loam to a depth of 37 inches and mottled, dark brown gravelly clay loam to a depth of 43 inches. The substratum is mottled, dark brown gravelly silt loam to a depth of 83 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, moderately well drained and somewhat poorly drained Albrights soils and very deep, poorly drained Brinkerton soils. The included soils make up about 10 percent of the map unit.

Permeability of this Buchanan soil is moderate above the fragipan and slow in the fragipan and the substratum. Available water capacity is low or moderate. Rooting depth is restricted by the fragipan at a depth of about 20 to 36 inches. The seasonal high water table is at a depth of about 18 to 36 inches in winter and spring. In unlimed areas the soil is extremely acid to moderately acid. Erosion is a severe hazard.

Most areas of this soil are woodland. Some areas are used for cultivated crops, pasture, and hayland and are idle. A few areas are in urban use.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. In some wet areas surface and subsurface drainage is needed to allow timely tillage.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is too wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table, slow permeability in the fragipan and the substratum, and slope are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIIe; the woodland ordination symbol is 4A.

BxB—Buchanan silt loam, 0 to 8 percent slopes, very stony. This is a nearly level and gently sloping, deep and very deep, moderately well drained and somewhat poorly drained soil on foot slopes and in drainageways. Slopes are smooth and slightly concave to slightly convex and range from 100 to 300 feet in length. Areas are irregular in shape and range from about 5 to 100 acres. Boulders and large stones cover 3 to 15 percent of the surface.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 43 inches. It is mottled, yellowish brown silt loam to a depth of 13 inches and mottled, yellowish brown clay loam to a depth of 26 inches. Below that, to a depth of 43 inches, it is a firm and brittle layer called a fragipan. The fragipan is mottled, brown gravelly clay loam to a depth of 37 inches and mottled, dark brown gravelly clay loam to a depth of 43 inches. The substratum is mottled, dark brown gravelly silt loam to a depth of 83 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, moderately well drained and somewhat poorly drained Albrights soils and very deep, poorly drained Brinkerton soils. The included soils make up about 10 percent of the map unit.

Permeability of this Buchanan soil is moderate above the fragipan and slow in the fragipan and the substratum. Available water capacity is low or moderate. Runoff is medium. Rooting depth is restricted by the fragipan at a depth of about 20 to 36 inches. The seasonal high water table is at a depth of 18 to 30 inches in winter and spring. The soil is moderately acid to extremely acid. Erosion is a moderate hazard.

Most areas of this soil are woodland. The soil is not used for cultivated crops or improved pasture because of the stones on the surface. Removing the trees and surface stones for these uses is not feasible.

This soil is well suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is generally not practical because of the stones on the surface. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table and slow permeability in the fragipan and the substratum are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass VIs; the woodland ordination symbol is 4A.

BxD—Buchanan silt loam, 8 to 25 percent slopes, very stony. This is a strongly sloping and moderately steep, deep and very deep, moderately well drained and somewhat poorly drained soil on foot slopes and in drainageways. Slopes are smooth and concave and generally range from 100 to 300 feet in length. Areas are generally elongated in shape and range from about 5 to 50 acres.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 43 inches. It is mottled, yellowish brown silt loam to a

depth of 13 inches and mottled, yellowish brown clay loam to a depth of 26 inches. Below that, it is a firm and brittle layer called a fragipan. The fragipan is mottled, brown gravelly clay loam to a depth of 37 inches and mottled, dark brown gravelly clay loam to a depth of 43 inches. The substratum is mottled, dark brown gravelly silt loam to a depth of 83 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, moderately well drained and somewhat poorly drained Albrights soils and very deep, poorly drained Brinkerton soils. The included soils make up about 10 percent of the map unit.

Permeability of this Buchanan soil is moderate above the fragipan and slow in the fragipan and the substratum. Available water capacity is low or moderate. Runoff is rapid. Rooting depth is restricted by the fragipan at a depth of about 20 to 36 inches. The seasonal high water table is at a depth of 18 to 36 inches in winter and spring. The soil is moderately acid to extremely acid. Erosion is a moderate hazard.

Most areas of this soil are woodland. The soil is not suited to cultivated crops or improved pasture because of the large surface stones. Removing the trees and surface stones for these uses is not feasible.

This soil is well suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is generally not practical because of the large stones. Thinning and removing undesirable species help to increase productivity. Laying out roads on the contour helps to control erosion.

The seasonal high water table, slow permeability in the fragipan and the substratum, and slope are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass VIs; the woodland ordination symbol is 3X.

CaA—Cavode silt loam, 0 to 3 percent slopes. This is a nearly level, deep and very deep, somewhat poorly drained soil on flat hilltops and on benches. Areas are roughly oval in shape and are about 5 to 20 acres.

Typically, the surface layer is very dark grayish brown silt loam about 1 inch thick. The subsurface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of 47 inches. It is mottled, yellowish brown silty clay loam to a depth of 13 inches and mottled, gray and light brownish gray silty clay loam to a depth of 47 inches. The substratum is light brownish gray very channery silty clay loam to a depth of 71 inches or more.

Included with this soil in mapping are small areas, less than 3 acres, of deep and very deep, moderately well drained Cookport soils, deep and very deep, moderately well drained Wharton soils, and very deep, poorly drained Brinkerton soils. The included soils make up about 15 percent of the map unit.

Permeability in this Cavode soil slow throughout. Available water capacity is moderate or high. Runoff is slow. The seasonal high water table is at a depth of 6 to 18 inches in winter and spring. Rooting depth is restricted by the seasonal high water table. In unlimed areas the soil is very strongly acid or strongly acid. Erosion is a slight hazard.

Most areas of this soil is woodland. Some areas are idle, and a few areas are used for cultivated crops.

This soil is suited to cultivated crops. The main limitation is the seasonal high water table. In some years, surface ponding damages crops. Conservation tillage, cover crops, and grasses and legumes included in the crop rotation help to maintain soil tilth. In some wet areas surface and subsurface drainage is needed to allow timely tillage and harvesting operations.

This soil is suited to pasture. The main concerns in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and productivity for northern red oak is moderately high. Machine planting is usually practical in the large areas. Thinning and removing undesirable species help to increase productivity. Where feasible, building main haul roads on adjacent, better drained soils allows the use of equipment.

The seasonal high water table and slow permeability are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIIw; the woodland ordination symbol is 4W.

CaB—Cavode silt loam, 3 to 8 percent slopes. This is a gently sloping, deep and very deep, somewhat poorly drained soil on gently sloping hilltops and benches. Slopes are smooth and concave and generally range from 50 to 200 feet in length. Areas are roughly oval in shape and range from about 5 to 20 acres.

Typically, the surface layer is very dark grayish brown silt loam about 1 inch thick. The subsurface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of 47 inches. It is mottled, yellowish brown silty clay loam to a depth of 13 inches and mottled, gray and light brownish gray silty clay loam to a depth of 47 inches. The substratum is light brownish gray very channery silty clay loam to a depth of 71 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep and very deep, moderately well drained Cookport soils, deep and very

deep, moderately well drained Wharton soils, and very deep, poorly drained Brinkerton soils. The included soils make up about 15 percent of the map unit.

Permeability in this Cavode soil is slow throughout. Available water capacity is moderate or high. Runoff is medium. The seasonal high water table is at a depth of 6 to 18 inches in winter and spring. Rooting depth is restricted by the seasonal high water table. In unlimed areas the soil is very strongly acid or strongly acid. Erosion is a moderate hazard.

Most areas of this soil are woodland. Some areas are idle, and a few areas are used for cultivated crops.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. In some wet areas surface and subsurface drainage is needed to allow timely tillage.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is well suited to trees, and productivity for northern red oak is moderately high. Machine planting is usually practical in the large areas. Thinning and removing undesirable species help to increase productivity. Where feasible, building main haul roads on adjacent, drier soils allows the use of equipment.

The seasonal high water table and slow permeability are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIIw; the woodland ordination symbol is 4W.

ChB—Chenango gravelly loam, 3 to 8 percent slopes. This is a gently sloping, very deep, well drained soil on stream terraces. Slopes are smooth and slightly concave. Areas are triangular or elongated oval in shape and range from about 5 to 20 acres.

Typically, the surface layer is dark brown gravelly loam about 7 inches thick. The subsoil extends to a depth of 31 inches. It is yellowish brown gravelly loam to a depth of 19 inches and yellowish brown very gravelly loam to a depth of 31 inches. The substratum is brown extremely gravelly loamy sand to a depth of 80 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, moderately well drained and somewhat poorly drained Braceville soils and very deep, somewhat poorly drained and poorly drained Rexford soils. The included soils make up about 10 percent of the map unit.

Permeability in this Chenango soil is moderate or moderately rapid in the surface layer and the subsoil and rapid in the substratum. Available water capacity is very low to moderate. Runoff is medium. In unlimed areas the soil is very strongly acid to moderately acid in the subsoil and strongly acid to neutral in the substratum. Erosion is a moderate hazard.

Most areas of this soil are used for cultivated crops, including corn, oats, wheat, and hay. Some areas are in urban use.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, and cover crops help to reduce runoff and to control erosion.

The soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and during long, dry periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for sugar maple is moderate. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

This soil has few limitations to urban use. If the soil is used for onsite waste disposal systems, moderately rapid and rapid permeability causes a hazard of ground water contamination.

This soil is in capability unit IIs; the woodland ordination symbol is 3A.

ClB—Clymer loam, 3 to 8 percent slopes. This is a gently sloping, deep and very deep, well drained soil on convex hilltops. Slopes are smooth and generally range from 50 to 200 feet in length. Areas are irregular in shape and range from about 5 to 40 acres.

Typically, the surface layer is a very dark grayish brown loam about 3 inches thick. The subsurface layer is brown channery sandy loam about 2 inches thick and yellowish brown channery loam 5 inches thick. The subsoil is yellowish brown channery loam to a depth of 31 inches. The substratum is yellowish brown extremely channery loam to a depth of 48 inches. Sandstone bedrock is at a depth of 48 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Hartleton and Hazleton soils and deep and very deep, moderately well drained Cookport soils. Also included are areas of nearly level soils. The included soils make up about 10 percent of the map unit.

Permeability in this Clymer soil is moderate throughout. Available water capacity is low to high. Runoff is medium. In unlimed areas the soil is strongly acid to extremely acid throughout. Erosion is a moderate hazard.

Most areas of this soil are woodland. A few areas are used for cultivated crops and pasture or are in urban use.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates

within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

This soil has few limitations to urban use. Depth to bedrock and moderate permeability are limitations for onsite waste disposal. If the soil is used for onsite waste disposal, larger absorption fields located on the areas deepest to bedrock or specially designed systems are needed.

This soil is in capability subclass IIe; the woodland ordination symbol is 4A.

CoA—Cookport loam, 0 to 3 percent slopes. This is a nearly level, deep and very deep, moderately well drained soil on broad hilltops. Areas are irregular in shape and range from about 5 to 20 acres.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is yellowish brown loam about 6 inches thick. The subsoil extends to a depth of 39 inches. It is yellowish brown clay loam to a depth of 16 inches. Below that, to a depth of 39 inches, it is a firm and brittle layer of mottled, yellowish brown loam called a fragipan. The substratum is mottled, brown gravelly sandy loam to a depth of 45 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Clymer and Hazleton soils, deep and very deep, moderately well drained Wharton soils, and very deep, poorly drained Brinkerton soils. The included soils make up about 10 percent of the map unit.

Permeability of this Cookport soil is moderate above the fragipan, slow in the fragipan, and moderately slow in the substratum. Available water capacity is low or moderate. Runoff is slow, and the surface is ponded after rainfall. Rooting depth is restricted by the fragipan at a depth of about 16 to 27 inches. The seasonal high water table is at a depth of 18 to 30 inches in winter and spring. In unlimed areas the soil is strongly acid to extremely acid. Erosion is a slight hazard.

Most areas of this soil are woodland. A few areas are used for cultivated crops and pasture or are in nonfarm use.

This soil is suited to cultivated crops. In some years the seasonal high water table and surface ponding delay planting or damage crops. In some wet areas surface and subsurface drainage is needed to allow timely tillage.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is too wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table and slow permeability in the fragipan are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIw; the woodland ordination symbol is 4W.

CoB—Cookport loam, 3 to 8 percent slopes. This is a gently sloping, deep and very deep, moderately well drained soil on uplands. Slopes are smooth and concave and generally range from 100 to 300 feet in length. Areas are irregular in shape and range from about 5 to 200 acres.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is yellowish brown loam about 6 inches thick. The subsoil extends to a depth of 39 inches. It is yellowish brown clay loam to a depth of 16 inches and mottled yellowish brown clay loam to a depth of 21 inches. Below that, to a depth of 39 inches, it is a firm and brittle layer of mottled, yellowish brown loam called a fragipan. The substratum is mottled, brown gravelly sandy loam to a depth of 45 inches. Gray sandstone bedrock is at a depth of 45 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Clymer and Hazleton soils, deep and very deep, moderately well drained Wharton soils, and very deep, poorly drained Brinkerton soils. The included soils make up about 10 percent of the map unit.

Permeability of this Cookport soil is moderate above the fragipan, slow in the fragipan, and moderately slow in the substratum. Available water capacity is low or moderate. Runoff is medium. Rooting depth is restricted by the fragipan at a depth of 16 to 27 inches. The seasonal high water table is at a depth of 18 to 30 inches in winter and spring. In unlimed areas the soil is strongly acid to extremely acid. Erosion is a moderate hazard.

Most areas of this soil are woodland. Some areas are used for cultivated crops and pasture and are in nonfarm uses.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. In some wet areas surface and subsurface drainage is needed to allow timely tillage.

This soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is too wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table and moderately slow permeability in the fragipan are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIe; the woodland ordination symbol is 4W.

CoC—Cookport loam, 8 to 15 percent slopes. This is a strongly sloping, deep and very deep, moderately well drained soil on hillsides. Slopes are smooth and concave and generally range from 50 to 200 feet long. Areas are irregular in shape and range from about 5 to 20 acres.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is yellowish brown loam about 6 inches thick. The subsoil extends to a depth of 39 inches. It is yellowish brown clay loam to a depth of 16 inches and mottled, yellowish brown clay loam to a depth of 21 inches. Below that, to a depth of 39 inches, it is a firm and brittle layer of mottled, yellowish brown loam called a fragipan. The substratum is mottled, brown gravelly sandy loam to a depth of 45 inches. Gray sandstone bedrock is at a depth of 45 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Hartleton and Hazleton soils and very deep, moderately well drained Buchanan soils. The included soils make up about 10 percent of the map unit.

Permeability of this Cookport soil is moderate above the fragipan, slow in the fragipan, and moderately slow in the substratum. Available water capacity is low or moderate. Runoff is rapid. Rooting depth is restricted by the fragipan at a depth of about 16 to 27 inches. The seasonal high water table is at a depth of 18 to 30 inches in winter and spring. In unlimed areas the soil is strongly acid to extremely acid. Erosion is a severe hazard.

Most areas of this soil are woodland. Some areas are used for cultivated crops, hay, and pasture and are in nonfarm uses.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. In some wet areas surface and subsurface drainage allows timely tillage.

The soil is suited to pasture. The main concerns in pasture management are overgrazing and grazing when the soil is too wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table, slow permeability in the fragipan, and slope are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIIe; the woodland ordination symbol is 4W.

CpB—Cookport loam, 0 to 8 percent slopes, very stony. This is a nearly level and gently sloping, deep and very deep, moderately well drained soil on broad hilltops. Slopes are smooth and slightly concave to slightly convex and range from 100 to 300 feet in length. Areas are irregular in shape and range from about 5 to 100 acres. Boulders and large stones cover 3 to 15 percent of the surface.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is yellowish brown loam about 6 inches thick. The subsoil extends to a depth of 39 inches. It is yellowish brown clay loam to a depth of 16 inches and mottled, yellowish brown clay loam to a depth of 21 inches. Below that, to a depth of 39 inches, it is a firm and brittle layer of mottled, yellowish brown loam called a fragipan. The substratum is mottled, brown gravelly sandy loam to a depth of 45 inches. Gray sandstone bedrock is at a depth of 45 inches.

Included with this soil in mapping are small areas, generally less than 5 acres, of deep, well drained Clymer and Hazleton soils and very deep, poorly drained Brinkerton soils. The included soils make up about 20 percent of the map unit.

Permeability of this Cookport soil is moderate above the fragipan, slow in the fragipan, and moderately slow in the substratum. Available water capacity is low or moderate. Runoff is medium. Rooting depth is restricted by the fragipan at a depth of about 16 to 27 inches. The seasonal high water table is at a depth of 18 to 30 inches in winter and spring. This soil is strongly acid to extremely acid. Erosion is a moderate hazard.

This soil is poorly suited to cultivated crops or to improved pasture because of the stones on the surface. It is not feasible to remove the trees and surface stones for cultivated crops or improved pasture.

This soil is well suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is generally not practical because of the stones on the surface. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table and slow permeability in the fragipan are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass VIs; the woodland ordination symbol is 4W.

CpD—Cookport loam, 8 to 25 percent slopes, very stony. This is a strongly sloping and moderately steep, deep and very deep, moderately well drained soil on hillsides. Slopes are smooth and concave and generally range from 200 to 500 feet in length. Areas are irregular in shape and range from about 5 to 30 acres.

Typically, the surface layer is very dark grayish brown loam about 3 inches thick. The subsurface layer is yellowish brown loam about 6 inches thick. The subsoil extends to a depth of 39 inches. It is yellowish brown clay loam to a depth of 16 inches and mottled, yellowish brown clay loam to a depth of 21 inches. Below that, to a depth of 39 inches, it is a firm and brittle layer of mottled, yellowish brown loam called a fragipan. The substratum is mottled, brown gravelly sandy loam to a depth of 45 inches. Gray sandstone bedrock is at a depth of 45 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Clymer and Hazleton soils, deep and very deep, moderately well drained Wharton soils, and very deep, poorly drained Brinkerton soils. The included soils make up about 10 percent of the map unit.

Permeability of this Cookport soil is moderate above the fragipan, slow in the fragipan, and moderately slow in the substratum. Available water capacity is low or moderate. Runoff is rapid. Rooting depth is restricted by the fragipan at a depth of about 16 to 27 inches. The seasonal high water table is at a depth of 18 to 30 inches in winter and spring. This soil is strongly acid to extremely acid. Erosion is a severe hazard.

This soil is poorly suited to cultivated crops or improved pasture because of the stones on the surface. It is not feasible to remove the trees and surface stones for cultivated crops and improved pasture.

This soil is well suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is generally not practical because of the stones on the surface. Erosion is a moderate hazard for logging. Thinning and removing undesirable species help to increase production. Laying out logging roads on the contour helps to control erosion.

The seasonal high water table, slow permeability in the fragipan, and slope are limitations of this soil for most urban uses, including onsite waste disposal and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass VIs; the woodland ordination symbol is 4W.

HaB—Hartleton channery silt loam, 3 to 8 percent slopes. This is a gently sloping, deep, well drained soil on convex hilltops. Slopes are smooth and convex and generally range from 50 to 300 feet in length. Areas are irregular in shape and range from about 5 to 20 acres.

Typically, the surface layer is a dark yellowish brown channery silt loam about 1 inch thick. The subsurface layer is yellowish brown channery silt loam about 10 inches thick. The subsoil extends to a depth of 39 inches. It is yellowish brown very channery silt loam to a depth of 32 inches and yellowish brown extremely channery silt loam to a depth of 39 inches. The substratum is yellowish brown extremely channery silt loam to a depth of 57 inches. Bedrock is at a depth of 57 inches.

Included with this soil in mapping are small intermingled areas, generally less than 3 acres, of deep, well drained Hazleton and Leck Kill soils and deep and very deep, moderately well drained Cookport soils. The included soils make up about 15 percent of the map unit.

Permeability of this Hartleton soil is moderate to moderately rapid throughout. Available water capacity is low or moderate. Runoff is medium. In unlimed areas the soil is strongly acid and very strongly acid throughout. Erosion is a moderate hazard.

Most areas of this soil are woodland. A few areas are used for cultivated crops and pasture and are in nonfarm uses.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concerns in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

Stones on the surface and depth to bedrock are limitations of this soil for urban uses. The stones are a

limitation for onsite waste disposal. Specially designed systems are needed for onsite waste disposal.

This soil is in capability unit IIe; the woodland ordination symbol is 4F.

HaC—Hartleton channery silt loam, 8 to 15 percent slopes. This is a strongly sloping, deep, well drained soil on convex hillsides. Slopes are smooth and about 200 to 300 feet long. Areas are oval or irregular in shape and about 5 to 20 acres.

Typically, the surface layer is a dark yellowish brown channery silt loam about 1 inch thick. The subsurface layer is yellowish brown channery silt loam about 10 inches thick. The subsoil extends to a depth of 39 inches. It is yellowish brown very channery silt loam to a depth of 32 inches. Below that, to a depth of 39 inches, it is yellowish brown extremely channery silt loam. The substratum is yellowish brown extremely channery silt loam to a depth of 57 inches. Bedrock is at a depth of 57 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Leck Kill and Hazleton soils. The included soils make up about 10 percent of the map unit.

Permeability of this Hartleton soil is moderate to moderately rapid throughout. Available water capacity is low or moderate. Runoff is rapid. In unlimed areas the soil is strongly acid and very strongly acid throughout. Erosion is a severe hazard.

Most areas of this soil are woodland. A few areas are used for cultivated crops and pasture and are in nonfarm uses.

This soil is suited to cultivated crops. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity. Laying out logging roads on the contour helps to control erosion.

Large stones on the surface and depth to bedrock are limitations of this soil for urban uses. The stones are a limitation for onsite waste disposal. Specially designed systems are needed for onsite waste disposal.

This soil is in capability unit IIIe; the woodland ordination symbol is 4F.

HaD—Hartleton channery silt loam, 15 to 25 percent slopes. This is a moderately steep, deep, well drained soil on convex and concave hillsides. Slopes are smooth and generally range from 100 to 300 feet in length. Areas are oval or elongated in shape and range from about 5 to 20 acres.

Typically, the surface layer is a dark yellowish brown channery silt loam about 1 inch thick. The subsurface layer is yellowish brown channery silt loam about 10 inches thick. The subsoil extends to a depth of 39 inches. It is yellowish brown very channery silt loam to a depth of 32 inches. Below that, to a depth of 39 inches, it is yellowish brown extremely channery silt loam. The substratum is yellowish brown extremely channery silt loam to a depth of 57 inches. Bedrock is at a depth of 57 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Hazleton and Leck Kill soils. The included soils make up about 10 percent of the map unit.

Permeability of this Hartleton soil is moderate to moderately rapid throughout. Available water capacity is low or moderate. Runoff is rapid. In unlimed areas the soil is strongly acid and very strongly acid throughout. Erosion is a severe hazard.

Most areas of this soil are woodland. A few areas are used for cultivated crops and pasture and are in nonfarm uses.

This soil is suited to cultivated crops. Erosion is a severe hazard. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Slope limits the use of equipment. Thinning and removing undesirable species help to increase productivity. Maintaining water bars on roads during harvesting helps to control erosion.

Slope and large stones on the surface are limitations of this soil for most urban uses. Locating absorption fields for onsite waste disposal systems on nearby, less steep soils is a suitable management practice.

This soil is in capability unit IVe; the woodland ordination symbol is 4R.

HbB—Hazleton channery loam, 3 to 8 percent slopes. This is a gently sloping, deep, well drained soil on convex hilltops. Slopes are smooth and generally range from 50 to 200 feet in length. Areas are irregular in shape and range from about 5 to 20 acres.

Typically, the surface layer is a very dark grayish brown channery loam about 3 inches thick. The subsoil extends to a depth of 34 inches. It is brown and strong brown channery sandy loam and channery loam to a depth of 12 inches and dark brown very channery and extremely channery sandy loam to a depth of 34 inches. The substratum is dark brown extremely channery sandy

loam to a depth of 43 inches. Sandstone bedrock is at a depth of 43 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Hartleton and Clymer soils and deep and very deep, moderately well drained Cookport soils. The included soils make up about 10 percent of the map unit.

Permeability of this Hazleton soil is moderately rapid to rapid throughout. Available water capacity is low or moderate. Runoff is medium. In unlimed areas the soil is strongly acid to extremely acid throughout. Erosion is a moderate hazard.

Most areas of this soil are woodland. A few areas are used for cultivated crops and pasture and are in nonfarm uses.

This soil is suited to cultivated crops. Erosion is a moderate hazard. Contour stripcropping, conservation tillage, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during long, dry periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

This soil has few limitations to urban use. If the soil is used for onsite waste disposal systems, the moderately rapid to rapid permeability causes a hazard of ground water contamination.

This soil is in capability unit IIe; the woodland ordination symbol is 4F.

HbC—Hazleton channery loam, 8 to 15 percent slopes. This is a strongly sloping, deep, well drained soil on convex hillsides. Slopes are smooth and about 200 to 300 feet long. Areas are oval or irregular in shape and about 5 to 20 acres in size.

Typically, the surface layer is a very dark grayish brown channery loam about 3 inches thick. The subsoil extends to a depth of 34 inches. It is brown and strong brown channery sandy loam and channery loam to a depth of 12 inches. Below that, to a depth of 34 inches, it is dark brown very channery sandy loam. The substratum is dark brown extremely channery and channery sandy loam to a depth of 43 inches. Sandstone bedrock is at a depth of 43 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Hartleton and Clymer soils and deep and very deep, moderately well drained Cookport soils. The included soils make up about 10 percent of the map unit.

Permeability of this Hazleton soil is moderately rapid or rapid throughout. Available water capacity is low or moderate. Runoff is rapid. In unlimed areas the soil is strongly acid to extremely acid throughout. Erosion is a severe hazard.

Most areas of this soil are woodland. A few areas are used for cultivated crops and pasture and are in nonfarm uses.

This soil is suited to cultivated crops. Erosion is a severe hazard. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity. Laying out logging roads on the contour helps to control erosion.

This soil has few limitations to urban use. If the soil is used for onsite waste disposal systems, the moderately rapid or rapid permeability causes a hazard of ground water contamination.

This soil is in capability unit IIIe; the woodland ordination symbol is 4F.

HdB—Hazleton channery loam, 0 to 8 percent slopes, very stony. This is a nearly level and gently sloping, deep, well drained soil on convex hilltops. Slopes are smooth and convex and range from 50 to 200 feet in length. Areas are irregular in shape and range from about 5 to 50 acres. Large stones cover 3 to 15 percent of the surface.

Typically, the surface layer is very dark grayish brown channery loam about 3 inches thick. The subsoil extends to a depth of 34 inches. It is brown and strong brown channery sandy loam and channery loam to a depth of 12 inches. Below that, to a depth of 34 inches, it is dark brown very channery sandy loam. The substratum is dark brown extremely channery and channery sandy loam to a depth of 43 inches. Sandstone bedrock is at a depth of 43 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Hartleton soils, deep and very deep, well drained Cookport soils, and soils where less than 3 percent of the surface is covered with stones. The included soils make up about 10 percent of the map unit.

Permeability of this Hazleton soil is moderately rapid or rapid throughout. Available water capacity is low or moderate. Runoff is medium. The soil is strongly acid to extremely acid throughout. Erosion is a moderate hazard.

Most areas of this soil are woodland. A few areas are in nonfarm uses.

This soil is poorly suited to cultivated crops and to improved pasture because of the stones on the surface.

It is not feasible to remove the trees and surface stones for cultivated crops or improved pasture.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is generally not practical because of the stones on the surface. Thinning and removing undesirable species help to increase productivity.

Stones on the surface are limitations of this soil for most nonfarm uses. If the soil is used for onsite waste disposal systems, moderately rapid and rapid permeability causes a hazard of ground water contamination.

This soil is in capability unit VIs; the woodland ordination symbol is 4F.

HdD—Hazleton channery loam, 8 to 25 percent slopes, very stony. This is a strongly sloping and moderately steep, deep, well drained soil on convex hillsides. Slopes are smooth and generally range from 200 to 500 feet in length. Areas are elongated in shape and range from about 5 to 50 acres. Large stones cover 3 to 15 percent of the surface.

Typically, the surface layer is very dark grayish brown channery loam about 3 inches thick. The subsoil extends to a depth of 34 inches. It is brown and strong brown channery sandy loam and channery loam to a depth of 12 inches. Below that, to a depth of 34 inches, it is dark brown very channery sandy loam. The substratum is dark brown extremely channery and channery sandy loam to a depth of 43 inches. Sandstone bedrock is at a depth of 43 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Hartleton soils, deep and very deep, moderately drained Cookport soils, and soils where less than 3 percent of the surface is covered with stones. The included soils make up about 10 percent of the map unit.

Permeability of this Hazleton soil is moderately rapid or rapid throughout. Available water capacity is low or moderate. Runoff is rapid. The soil is strongly acid to extremely acid throughout. Erosion is a severe hazard.

Most areas of this soil are woodland. A few acres are in nonfarm uses.

This soil is poorly suited to cultivated crops and to improved pasture because of the stones on the surface. It is not feasible to remove the trees and surface stones for cultivated crops or improved pasture.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is generally not practical because of the stones on the surface. Erosion is a moderate hazard for logging. Thinning and removing undesirable species help to increase productivity. Laying out logging roads on the contour helps to control erosion.

Slope is a limitation of this soil for most urban uses. If the soil is used for onsite waste disposal systems, moderately rapid to rapid permeability causes a hazard of ground water contamination. Locating these systems in areas of the map unit where slope is less than 15 percent helps to overcome the slope limitation, but additional measures are needed to prevent ground water contamination.

This soil is in capability unit VIs; the woodland ordination symbol is 4R.

HeF—Hartleton and Buchanan soils, 25 to 60 percent slopes. These are steep and very steep soils on hillsides. Slopes are smooth, concave, and convex and generally range from 200 to 800 feet in length. Areas are elongated in shape and range from about 20 to 200 acres or more. Some areas consist mostly of deep, well drained Hartleton soils, some mostly of very deep, moderately well drained and somewhat poorly drained Buchanan soils, and some of both. In units with both Hartleton and Buchanan soils, the Hartleton soils are generally higher on the hillside than the Buchanan soils. Because of similar interpretations, separate mapping of these soils was not practical or necessary for the expected use. The mapped areas of this map unit are approximately 45 percent Hartleton soils, 35 percent Buchanan soils, and 20 percent other soils.

Typically, the surface layer of the Hartleton soils is dark yellowish brown channery silt loam about 1 inch thick. The subsurface layer is yellowish brown channery silt loam about 10 inches thick. The subsoil is yellowish brown very channery silt loam to a depth of 32 inches, and yellowish brown extremely channery silt loam to a depth of 39 inches. The substratum is yellowish brown extremely channery silt loam to a depth of 57 inches. Bedrock is at a depth of 57 inches.

Typically, the surface layer of the Buchanan soils is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 43 inches. It is mottled, yellowish brown silt loam to a depth of 13 inches and mottled, yellowish brown clay loam to a depth of 26 inches. Below that, it is a firm and brittle layer called a fragipan. The fragipan is mottled, brown gravelly clay loam to a depth of 37 inches and mottled, dark brown gravelly clay loam to a depth of 43 inches. The substratum is mottled, dark brown gravelly silt loam to a depth of 83 inches or more.

Included with these soils in mapping are small areas, generally less than 10 acres, of deep, well drained Hazleton and Leck Kill soils and, on narrow benches, gently sloping and strongly sloping, deep and very deep, moderately well drained Cookport soils. In some map units stones cover 3 to 50 percent of the surface. The included soils make up about 20 percent of the map unit.

Permeability is moderate to moderately rapid throughout in the Hartleton soils and moderate above the fragipan and slow in the fragipan and in the substratum in the Buchanan soils. Available water capacity is low or moderate for both soils. Runoff is very rapid. Rooting depth in the Buchanan soil is restricted by

the fragipan at a depth of about 20 to 36 inches. The seasonal high water table in the Buchanan soil is at a depth of about 18 to 36 inches in winter and spring. The Hartleton soils are strongly acid and very strongly acid, and the Buchanan soils range from extremely acid to strongly acid. Erosion is a severe hazard.

Most areas of these soils are wooded.

These soils are poorly suited to cultivated crops and to pasture because of slope.

These soils are suited to trees, and potential productivity for northern red oak is moderately high for both Hartleton and Buchanan soils. Slope limits the use of equipment. Erosion is a hazard.

Slope is a limitation of these soils for urban uses. The included areas of Hazleton and Leck Kill soils have few limitations to some urban uses.

These soils are in capability unit VIIe; the woodland ordination symbol is 4R.

LeB—Leck Kill channery silt loam, 3 to 8 percent slopes. This is a gently sloping, deep, well drained soil on hilltops. Slopes are smooth and convex and range from 100 to 300 feet in length. Areas are generally elongated oval in shape and range from about 5 to 20 acres.

Typically, the surface layer is dark brown channery silt loam about 6 inches thick. The subsoil is dark reddish brown channery silt loam to a depth of 26 inches. The substratum is dark reddish brown extremely channery silt loam to a depth of 44 inches. Dusky red shale bedrock is at a depth of 44 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Hartleton soils and very deep, moderately well drained and somewhat poorly drained Albrights soils. The included soils make up about 5 percent of the map unit.

Permeability of this Leck Kill soil is moderate to moderately rapid throughout. Available water capacity is moderate or high. Runoff is medium. In unlimed areas the soil is very strongly acid to moderately acid throughout. Erosion is a moderate hazard.

Most areas of this soil are used as cropland. A few areas are woodland and pasture and in nonfarm uses.

This soil is suited to cultivated crops. Erosion is a moderate hazard. Contour stripcropping, conservation tillage, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity.

This soil has few limitations to urban use. Depth to bedrock and permeability are limitations for onsite waste disposal systems. If the soil is used for onsite waste disposal systems, in some areas larger absorption fields located on the areas deepest to bedrock or specially designed systems are needed.

This soil is in capability unit IIe; the woodland ordination symbol is 4A.

LeC—Leck Kill channery silt loam, 8 to 15 percent slopes. This is a strongly sloping, deep, well drained soil on convex hillsides. Slopes are smooth and about 200 to 300 feet long. Areas are oval or irregular in shape and about 5 to 20 acres.

Typically, the surface layer is dark brown channery silt loam about 6 inches thick. The subsoil is dark reddish brown channery silt loam to a depth of 26 inches. The substratum is dark reddish brown extremely channery silt loam to a depth of 44 inches. Dusky red shale bedrock is at a depth of 44 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep, well drained Hartleton soils, very deep, well drained Meckesville soils, and very deep, moderately well drained and somewhat poorly drained Albrights soils. The included soils make up about 5 percent of the map unit.

Permeability of this Leck Kill soil is moderate to moderately rapid throughout. Available water capacity is moderate or high. Runoff is rapid. In unlimed areas the soil is very strongly acid to moderately acid throughout. Erosion is a severe hazard.

Most areas of this soil are used as cropland. Some areas are used as woodland and pasture (fig. 9) and are in nonfarm uses.

This soil is suited to cultivated crops. Erosion is a severe hazard. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is practical in the large areas. Thinning and removing undesirable species help to increase productivity. Laying out logging roads on the contour helps to control erosion. Erosion control is needed during harvesting.

This soil has few limitations to urban use. Permeability is a limitation for onsite waste disposal systems. If the soil is used for onsite waste disposal systems, in some areas larger absorption fields located on the areas deepest to bedrock or specially designed systems are needed.

This soil is in capability unit IIIe; the woodland ordination symbol is 4A.

Figure 9.—Leck Kill channery silt loam, 8 to 15 percent slopes, in pasture (foreground). This soil is suited to pasture. Adjacent to the Leck Kill soil, on the gentle slopes (middle ground), are Albrights silt loam, 3 to 8 percent slopes, and Buchanan silt loam, 3 to 8 percent slopes.

LeD—Leck Kill channery silt loam, 15 to 25 percent slopes. This is a moderately steep, deep, well drained soil on hillsides. Slopes are smooth and generally range from 100 to 300 feet in length. Areas are oval or elongated in shape and range from about 5 to 20 acres.

Typically, the surface layer is dark brown channery silt loam about 6 inches thick. The subsoil is dark reddish brown channery silt loam to a depth of 26 inches. The substratum is dark reddish brown extremely channery silt loam to a depth of 44 inches. Dusky red shale bedrock is at a depth of 44 inches.

Included in mapping are small areas, generally less than 3 acres, of deep, well drained Hartleton soils, very deep, well drained Meckesville soils, and very deep, moderately well drained and somewhat poorly drained Albrights soils. The included soils make up about 15 percent of the map unit.

Permeability of this Leck Kill soil is moderate to moderately rapid throughout. Available water capacity is moderate or high. Runoff is very rapid. In unlimed areas the soil is very strongly acid to moderately acid throughout. Erosion is a severe hazard.

Most areas of this soil are used for pasture. A few areas are used for cultivated crops and as woodland and are in nonfarm uses.

This soil is suited to cultivated crops. Erosion is a very severe hazard. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Slope limits the use of equipment. Thinning and removing undesirable species help to increase productivity. Maintaining water bars on logging roads during harvesting helps to control erosion.

Slope is a limitation of this soil for most urban uses. Locating the absorption fields of onsite waste disposal systems on nearby, less steep soils is a suitable management practice.

This soil is in capability unit IVe; the woodland ordination symbol is 4R.

LeF—Leck Kill channery silt loam, 25 to 50 percent slopes. This is a steep and very steep soil on hillsides. Slopes are smooth and concave or convex and generally range from 500 to 1,000 feet in length. Areas are elongated in shape and range from about 15 to 500 acres. In most areas the surface texture is channery silt loam, but some areas are rocky. The steep and very steep slopes are the dominant feature of the soil for the present and expected uses. Consequently, the rocky areas were not mapped separately.

Typically, the surface layer is dark brown channery silt loam about 6 inches thick. The subsoil is dark reddish brown channery silt loam to a depth of 26 inches. The substratum is dark reddish brown extremely channery silt loam to a depth of 44 inches. Dusky red shale bedrock is at a depth of 44 inches.

Included with these soils in mapping are small areas, generally less than 5 acres, of very deep, well drained Meckesville soils and deep, well drained Hartleton soils. Also included, on small benches, are small areas of Leck Kill soils on slopes of less than 25 percent. The included soils make up about 20 percent of the map unit.

Permeability of this Leck Kill soil is moderate to moderately rapid throughout. Available moisture capacity is moderate or high. Runoff is very rapid. In unlimed areas the soil is very strongly acid to moderately acid throughout. Erosion is a very severe hazard.

Most areas of these soils are used as woodland.

This soil is poorly suited to cultivated crops and to pasture because of slope.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Slope restricts the use of equipment. Erosion is a severe hazard.

The steep and very steep slope is a limitation of this soil for urban uses. Selecting sites for urban uses on nearby, more level areas or benches is a suitable management practice.

This soil is in capability unit VIIe; the woodland ordination symbol is 4R.

MeD—Meckesville channery silt loam, 15 to 25 percent slopes. This is a moderately steep, very deep, well drained soil on convex and concave, lower hillsides. Slopes are smooth and generally range from 150 to 300 feet in length. Areas are elongated or irregular in shape and range from about 5 to 20 acres.

Typically, the surface layer is dark reddish gray channery silt loam about 9 inches thick. The subsoil extends to a depth of 51 inches. It is reddish brown channery silt loam and silty clay loam to a depth of 24 inches. Below that, to a depth of 51 inches, it is a firm and brittle layer of channery silty clay loam called a fragipan. The substratum extends to a depth of 66 inches. It is olive brown extremely channery silty clay loam to a depth of 56 inches and reddish brown extremely channery silty clay loam to a depth of 66 inches. Dusky red and grayish brown shale and sandstone bedrock is at a depth of 66 inches.

Included in mapping are small areas, generally less than 3 acres, of deep, well drained Leck Kill soils and very deep, moderately well drained and somewhat poorly drained Albrights soils. The included soils make up about 10 percent of the map unit.

Permeability of this Meckesville soil is moderate above the fragipan and moderately slow in the fragipan and in the substratum. Available water capacity is low or moderate. The seasonal high water table is at a depth of 30 to 48 inches. In unlimed areas the soil is strongly acid to extremely acid throughout. Erosion is a severe hazard.

Most areas of this soil are used for cultivated crops and pasture. A few areas are used as woodland and are in nonfarm uses.

This soil is suited to cultivated crops. Erosion is a very severe hazard. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion.

This soil is suited to pasture. The main concern in pasture management is overgrazing. Stocking rates within carrying capacity, rotation grazing, and deferred grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Slope limits the use of equipment. Thinning and removing undesirable species help to increase productivity. Maintaining water bars on logging roads during harvesting helps to control erosion.

Slope is a limitation of this soil for most urban uses. Selecting sites for absorption fields of onsite waste disposal systems on nearby, less steep soils is a suitable management practice.

This soil is in capability unit IVe; the woodland ordination symbol is 4R.

Pa—Palms muck. This is a nearly level, very deep, very poorly drained soil in basins along the major streams in the northeastern part of the county. Areas are irregular in shape and range from 5 to 50 acres. Slopes range from 0 to 2 percent.

Typically, in the uppermost 10 inches the soil is black muck. Below that, it is very dark brown muck to a depth of 23 inches and dark brown muck to a depth of 40 inches. The underlying material is dark gray silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of very deep, poorly drained Atkins soils, very deep, somewhat poorly drained and poorly drained Rexford soils, and very deep, moderately well drained and somewhat poorly drained Basher soils. The included soils make up about 10 percent of the map unit.

Permeability of this Palms soil is moderately slow to moderately rapid in the organic layers and moderately

slow to moderate in the underlying material. Available water capacity is high. Runoff is slow, and the surface is frequently ponded. The seasonal high water table is at or near the surface during most of the year. In unlimed areas the soil is slightly acid or neutral. Erosion is a slight hazard.

About one-fourth of the acreage of this soil has been drained and cultivated. The rest is in native vegetation, mainly cattails, sedges, and sphagnum moss. A few areas are wooded.

In drained areas where the water level is controlled, this soil is suited to most crops, including truck crops. In undrained areas, it is suited to use as habitat for wetland wildlife.

This soil is poorly suited to trees, and potential productivity for red maple is moderate. The seasonal high water table limits the use of equipment for planting and harvesting.

The seasonal high water table and flooding are limitations of this soil for most urban uses, including onsite waste disposal systems and sites for buildings with basements. Selecting sites for onsite waste disposal systems and for buildings with basements on adjacent, better drained soils is a suitable management practice.

This soil is in capability subclass 4w; the woodland ordination symbol is 2W.

Ph—Philo silt loam. This is a nearly level, very deep, moderately well drained soil on flood plains. Slopes range from 0 to 3 percent. Areas are generally long and narrow in shape and range from about 5 to 50 acres.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is yellowish brown silt loam to a depth of 15 inches and mottled, brown fine sandy loam to a depth of 34 inches. The substratum is mottled, gray sandy loam to a depth of 46 inches and gray very gravelly loamy sand to a depth of 66 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, well drained Pope soils and very deep, poorly drained Atkins soils. The included soils make up about 15 percent of the map unit.

Permeability of this Philo soil is moderate in the subsoil and in the upper part of the substratum and moderately rapid in the lower part of the substratum. Available water capacity is moderate or high. Runoff is slow. Flooding is occasional. The seasonal high water table is at a depth of 18 to 36 inches in winter and spring. In unlimed areas the soil ranges from slightly acid to very strongly acid throughout. Erosion is a slight hazard.

Most areas of this soil are used for cultivated crops, hay, and pasture. Some areas are wooded.

This soil is suited to cultivated crops. In some years, flooding delays planting or damages crops. Cover crops help to control scouring by floodwater.

Overgrazing and grazing when the soil is too wet are major concerns in pasture management. Stocking rates within carrying capacity, deferred grazing, rotation grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and productivity for northern red oak is moderately high. Flooding impedes the use of equipment, but only for short periods. Machine planting is generally practical.

Flooding and wetness are limitations of this soil for most urban uses, including onsite waste disposal systems and sites for dwellings with basements.

This soil is in capability subclass IIw; the woodland ordination symbol is 5W.

Po—Pope loam. This is a nearly level, very deep, well drained soil on flood plains. Slopes range from 0 to 3 percent. Areas are generally long and narrow in shape and range from about 5 to 30 acres.

Typically, the surface layer is brown loam about 6 inches thick. The subsoil is yellowish brown fine sandy loam to a depth of 41 inches. The substratum is yellowish brown sandy loam to a depth of 65 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, moderately well drained Philo soils and very deep, poorly drained Atkins soils. The included soils make up about 15 percent of the map unit.

Permeability of this Pope soil is moderate or moderately rapid throughout. Available water capacity is moderate or high. Runoff is slow. Flooding is occasional. In unlimed areas the soil is strongly acid or very strongly acid throughout. Erosion is a slight hazard.

Most areas of this soil are used for cultivated crops, hay, and pasture. Some areas are wooded.

The soil is suited to cultivated crops. In some years flooding delays planting. Cover crops help to control scouring by floodwater.

This soil is suited to pasture. The major concern in pasture management is overgrazing. Stocking rates within carrying capacity, deferred grazing, and rotation grazing are suitable management practices.

This soil is suited to trees, and productivity for northern red oak is moderately high. In some years flooding impedes the use of machinery, but only for short periods. Machine planting is generally practical.

Flooding is a limitation of this soil for most urban uses, including onsite waste disposal systems and sites for buildings with basements.

This soil is in capability class I; the woodland ordination symbol is 5A.

ReA—Rexford silt loam, 0 to 3 percent slopes. This is a nearly level, very deep, somewhat poorly drained and poorly drained soil on stream terraces. Areas are

generally elongated oval in shape and range from about 5 to 20 acres.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 39 inches. It is mottled, yellowish brown silt loam to a depth of 11 inches and mottled, brown silt loam to a depth of 18 inches. Below that it is a firm and brittle layer called a fragipan. The fragipan is mottled, brown loam to a depth of 34 inches and dark brown gravelly loam to a depth of 39 inches. The substratum is dark brown gravelly sandy loam to a depth of 47 inches and dark brown gravelly loamy sand to a depth of 60 inches or more.

Included with this soil in mapping are small areas, generally less than 3 acres, of very deep, well drained Chenango soils and very deep, moderately well drained and somewhat poorly drained Braceville soils. The included soils make up about 10 percent of the map unit.

Permeability of this Rexford soil is moderate above the fragipan, slow in the fragipan, and moderately slow to moderate in the upper part of the substratum, and moderately rapid to rapid in the lower part of the substratum. Available water capacity is moderate. Runoff is slow. Rooting depth is restricted by the fragipan at a depth of 15 to 24 inches. The seasonal high water table is between the surface and a depth of 18 inches in winter and spring. In unlimed areas the soil is strongly acid or moderately acid throughout. Erosion is a slight hazard.

Most areas of this soil are used for cultivated crops. Some areas are idle, and a few areas are woodland.

This soil is suited to cultivated crops. The main limitation is the seasonal high water table. In some years surface ponding damages crops. Conservation tillage, cover crops, and grasses and legumes included in the cropping system help to maintain soil tilth. In some wet areas surface and subsurface drainage is needed to allow timely tillage and harvesting operations.

This soil is suited to pasture. The main concerns in pasture management are grazing when the soil is too wet and overgrazing. Stocking rates within carrying capacity, rotational grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and productivity for northern red oak is moderately high. Machine planting is generally practical in the large areas. Thinning and removing undesirable species help to increase productivity. Laying out logging roads on the contour helps to control erosion. Where feasible, building main haul roads on adjacent, better drained soils allows the use of equipment.

The seasonal high water table and slow permeability in the fragipan are limitations of this soil for most urban uses. If the soil is used for onsite waste disposal, specially designed systems are needed to help prevent ground water contamination. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIIw; the woodland ordination symbol is 4W.

Sm—Udorthents, extremely channery. These are nearly level to very steep, very deep, and well drained to somewhat poorly drained soils on uplands. The areas of these soils consist of mixed soil material and bedrock from strip mines. Slopes are smooth and irregular and 100 to 500 feet long. Slopes range from 0 to 80 percent. Individual areas are irregular in shape and range from 5 to 100 acres.

These soils differ greatly from place to place. In many areas, however, they range from gray to brown to olive, are loamy, and have differing amounts of rock fragments.

Included with these soils in mapping are areas of soils that have not been altered by mining operations. Also included are small areas of mine dumps, quarries, and gravel pits. The included areas make up about 10 percent of the map unit.

Permeability of Udorthents, extremely channery, is slow to rapid, and available water capacity is moderate or high. Runoff is slow to very rapid, depending on slope and plant cover. The soil is strongly acid to extremely acid throughout. The hazard of erosion is moderate or severe.

Most of these soils are woodland or idle. A few areas are used as landfills.

Rock fragments and the need for drainage and reclamation are limitations to use of these soils for farming and for nonfarm uses. Onsite investigation is needed to determine the potential and the limitations for any proposed use.

This map unit has not been assigned to a capability subclass or given a woodland ordination symbol.

WaB—Wharton silt loam, 3 to 8 percent slopes. This is a gently sloping, deep and very deep, moderately well drained soil on hilltops and benches. Slopes are smooth and slightly concave and generally range from 50 to 200 feet in length. Areas are generally oval in shape and range from about 5 to 25 acres.

Typically, the surface layer is brown silt loam about 7 inches thick. The subsoil extends to a depth of 43 inches. It is yellowish brown silty clay loam to a depth of 19 inches and mottled, yellowish brown silty clay loam to a depth of 43 inches. The substratum is brown extremely channery silt loam to a depth of 53 inches. Shale bedrock is at a depth of 53 inches.

Included with this soil in mapping are small areas, generally less than 3 acres, of deep and very deep, moderately well drained Cookport soils and very deep, somewhat poorly drained Cavode soils. The included soils make up about 10 percent of the map unit.

Permeability of this Wharton soil is moderately slow or slow throughout. Available water capacity is moderate. Runoff is medium. The seasonal high water table is at a depth of 18 to 36 inches in winter and spring. Rooting depth is restricted by the seasonal high water table. In unlimed areas the soil ranges from strongly acid to extremely acid throughout. Erosion is a moderate hazard.

Most areas of this soil are woodland. Some areas are used for cultivated crops and pasture.

This soil is suited to cultivated crops. Erosion is a moderate hazard. Contour stripcropping, conservation tillage, grassed waterways, diversions, and cover crops help to reduce runoff and to control erosion. In some wet areas surface and subsurface drainage is needed to allow timely tillage.

This soil is suited to pasture. The major concerns in pasture management are overgrazing and grazing when the soil is wet. Stocking rates within carrying capacity, rotation grazing, deferred grazing, and, during wet periods, restricted grazing are suitable management practices.

This soil is suited to trees, and potential productivity for northern red oak is moderately high. Machine planting is usually practical in the large areas. Thinning and removing undesirable species help to increase productivity.

The seasonal high water table and moderately slow or slow permeability are limitations of this soil for most urban uses, including onsite waste disposal systems and sites for buildings with basements. Specially designed systems are needed for onsite waste disposal. Foundation drains with proper outlets help to prevent seepage into the basements of buildings.

This soil is in capability subclass IIe; the woodland ordination symbol is 4A.

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. Identification of prime farmland is a major step in meeting the Nation's needs for food and fiber.

The U.S. Department of Agriculture defines prime farmland as the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops while using acceptable farming methods. Prime farmland produces the highest yields and requires minimal amounts of energy and economic resources, and farming it results in the least damage to the environment.

An area identified as prime farmland must be used for producing food or fiber or must be available for those uses. Thus, urban and built-up land and water areas are not classified as prime farmland.

The general criteria for prime farmland are as follows: a generally adequate and dependable supply of moisture from precipitation or irrigation, favorable temperature and growing-season length, acceptable levels of acidity or alkalinity, few or no rocks, and permeability to air and water. Prime farmland is not excessively erodible, is not saturated with water for long periods, and is not flooded during the growing season. The slope range is mainly from 0 to 6 percent. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

The survey area contains about 140,000 acres of prime farmland. That acreage makes up about 22 percent of the total acreage in the survey area and is scattered throughout the county.

The soil map units that make up prime farmland in the survey area are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4, and the location of each unit is shown on the detailed soil maps at the back of this publication. The soil properties and characteristics that affect use and management of the units are described in the section "Detailed Soil Map Units."

Some soils in table 5 are classified as prime farmland if certain limitations of the soil are overcome. The measures needed to overcome the limitations of such soils are given in parentheses after the name of the map unit.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

John C. Spitzer, conservation agronomist, Soil Conservation Service, helped to prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

The major management concerns when using soils for crops and pasture are described in this section. In addition, the crops or pasture plants best adapted to a soil, including some not commonly grown in the survey area, are discussed. The system of land capability classification used by the Soil Conservation Service is explained and the predicted yields of the main crops and hay and pasture plants are given for each soil.

This section provides information about the overall agriculture potential and needed practices in the survey area for use by workers for agribusiness, equipment dealerships, drainage contracting, fertilizer companies, and processing companies, as well as by planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Detailed Soil Map Units." Before making plans for management systems for individual fields or farms, check for detailed information given in the description of each soil.

In 1981 livestock and livestock products accounted for most farm income in the county (*12*).

In 1974, 32,673 acres was used for cropland and pasture in McKean County, according to the 1975 Conservation Needs Inventory. Of this total, 11,473 acres was used for permanent pasture; 1,800 acres was used for row crops, mainly corn for grain; 9,900 acres was used for permanent and rotation hay; 2,000 acres was used for small grain; and 100 acres was used as orchards and for vegetables.

About 80,515 acres of prime farmland is used as woodland, and about 288 acres is used as pastureland. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Soil erosion is the major soil management problem on most cropland and pasture in the county.

Cookport, Hartleton, and Clymer soils are potentially productive cropland and pasture, but in areas where slope is more than 3 percent, erosion is a moderate or severe hazard.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a layer in or below the subsoil that restricts the depth of the root zone. Depth to a fragipan that limits rooting depth in Albrights soils is 18 to 30 inches and in Buchanan soils is 20 to 36 inches.

Second, soils that tend to be droughty, such as Chenango soils, erosion reduces productivity because losing organic matter and destroying the structure of the surface layer reduce the available water capacity. On farmland, erosion can pollute streams and reservoirs through sediment deposition. Erosion control minimizes the pollution of streams and helps to maintain water quality for municipal use, recreation, and fish and wildlife.

In some map units the surface layer is channery loam or channery silt loam. In these areas the preparation of a good seedbed and tilling are difficult because most of the original surface layer has been eroded away and channery fragments have been left on the surface. Such areas are common on Hartleton and Chenango soils. Erosion control practices provide a protective surface cover, reduce surface runoff, and increase infiltration. A cropping system that keeps a vegetative cover on the soil for extended periods keeps soil erosion losses to a minimum.

On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system help to control erosion, to provide nutrients, and to improve soil tilth.

Contour farming and stripcropping, which are common erosion control practices in the survey area, are best suited to soils that have smooth, uniform slopes. Such soils include most areas of Hazleton, Hartleton, Albrights, Cookport, and Buchanan soils. However, in some areas of these soils slopes are irregular and contour tillage or terracing is impractical. In these areas, a cropping system that includes a substantial vegetative cover is needed to control erosion. Conservation tillage increases the protection of the soil. Conservation tillage, cover crops, and crop residue left on the surface help to increase water infiltration and to control erosion. These practices are suitable on most soils in the survey area. No-tillage for corn is effective in controlling erosion and is suitable on most soils in the survey area.

Diversions, which reduce the length of slope, help to control erosion. They are most practical on deep, well drained soils that have regular slopes. Diversions are suitable on Albrights and Buchanan soils. They are less suitable on soils that have irregular slopes, that become excessively wet in the diversion channels, or that have bedrock at a depth of less than 40 inches.

Information about the design of erosion control practices for each kind of soil is available in local field offices of the Soil Conservation Service.

Soil drainage is a major management need on soils that have a seasonal high water table and that are used for crops and pasture. Some soils are naturally so wet that the production of crops or pasture common to the area is generally not successful without artificial drainage. Examples of soils that have a seasonal high water table are poorly drained Atkins and Brinkerton soils.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed in most areas of poorly drained soils used for intensive cropping systems. Drains have to be more closely spaced in soils where permeability is slow than in the more permeable soils. Locating adequate outlets for drainage systems is commonly difficult in some areas.

Soil fertility is naturally low in some soils in the survey area. On many soils on uplands which are naturally strongly acid, applications of ground limestone are needed to supply calcium and to raise the pH sufficiently for good growth of alfalfa and other crops. On most soils the levels of available phosphorus and magnesium are naturally low. Additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of lime and fertilizer to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction

and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*8*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. The levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

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Diversions, which reduce the length of slope, help to control erosion. They are most practical on deep, well drained soils that have regular slopes. Diversions are suitable on Albrights and Buchanan soils. They are less suitable on soils that have irregular slopes, that become excessively wet in the diversion channels, or that have bedrock at a depth of less than 40 inches.

Information for the design of erosion control practices for each kind of soil is available in local field offices of the Soil Conservation Service.

Soil drainage is a major management need on soils that have a seasonal high water table and that are used for crops and pasture. Some soils are naturally so wet that the production of crops or pasture common to the area is generally not successful without artificial drainage. Examples of soils that have a seasonal high water table are poorly drained Atkins and Brinkerton soils.

The design of both surface and subsurface drainage systems varies with the kind of soil. A combination of surface drainage and tile drainage is needed in most areas of poorly drained soils used for intensive cropping systems. Drains have to be more closely spaced in soils where permeability is slow than in the more permeable soils. Locating adequate outlets for drainage systems is commonly difficult in some areas.

Soil fertility is naturally low in some soils in the survey area. On many soils on uplands which are naturally strongly acid, applications of ground limestone is needed to supply calcium and to raise the pH sufficiently for good growth of alfalfa and other crops. On most soils available phosphorus and magnesium levels are naturally low. Additions of lime and fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of lime and fertilizer to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Woodland Management and Productivity

William H. Clifton, forester, Soil Conservation Service, helped to prepare this section.

There are approximately 559,600 acres of forest land in McKean County (*11*). This acreage amounts to 88 percent of the total land area. Of the 551,500 acres of commercial forest land in the county, 71 percent is privately owned and 29 percent is publicly owned. Nearly 1.5 percent of the forest land is classified as noncommercial. Stands of second- and third-growth trees make up the forest land.

Three major forest types make up the forest land in the county. They are the northern hardwood type, the oak type, and the softwood type. The constituent tree species and the extent of each type, according to the U.S. Forest Service and modified by the Pennsylvania Bureau of Forestry, are as follows (*9*).

The northern hardwood type makes up 86 percent of the commercial forest land. This type includes sugar maple, beech, and black cherry. The common associates are red maple, sweet birch, white ash, yellow birch, northern red oak, aspen, hickory, hemlock, and white pine.

The cherry-maple, or Allegheny hardwood, forest type makes up a major part of the northern hardwood type in the commercial forest land. This type is of high economic importance to local wood industries, to other domestic markets, and to the international market.

The oak type makes up 12 percent of the commercial forest land. This type includes areas of oak-pine and oak-hickory. Red oak makes up most of the stocking. There are some patches of white oak. Chestnut oak is in a few locations. The common associates include red maple, black cherry, hickory, white ash, sweet birch, beech, and sugar maple.

The softwood type makes up 2 percent of the commercial forest land. This type includes white pine and hemlock and plantings that consist mainly of red, white, and Scotch pine and Norway and white spruce. The common associates are red maple, red oak, sweet birch, yellow birch, basswood, white ash, beech, black cherry, and aspen.

Approximately 59 percent of the commercial forest land is sawtimber, 33 percent is poletimber, and 8 percent is seedlings and saplings and is stands less than 10 percent of which consists of growing stock trees.

In general, the soils in the county are capable of supporting good stands of red oak, sugar maple, black cherry, and white pine. Trees grow better on deeper, well drained soils than on poorly drained soils and on soils that are shallow to bedrock.

Forest landowners can encourage the growth of desirable trees by using good forest land management practices. In existing stands there are generally too many trees for best growth and development. The forest managers can improve the forest by favoring the species of higher economic value or of greater potential for volume growth. Or, they can favor whatever species that best meet the desired objectives. A forester can provide professional assistance for a forest improvement program.

The climate in McKean County is ideal for maple sugar production. Sugarbushes, an orchard or grove of sugar maples, can be established on deep, well drained and moderately well drained soils where poletimber-sized sugar maples are already predominant.

The forest land in McKean County has value for watershed protection, recreation, wildlife, and aesthetics. It also has value as a potential source of income for wood crops. The better sites that are properly managed and that are protected from fire, disease, insects, and livestock grazing should return a good profit to the owners.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed in the tables. The table gives the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, that the indicator species can produce. The larger the number, the greater the potential productivity. The number 1 indicates low productivity; 2 and 3, moderate; 4 and 5, moderately high; and 6 through 8, high.

The second part of the symbol, a letter, indicates the major kind of soil limitation for use and management. The letter *R* indicates steep slopes; *X*, stones or rocks on the surface; *W*, excessive water in or on the soil; and *F*, high content of rock fragments in the soil profile. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R,X,W, and F.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that erosion can occur as a result of site preparation or following cutting operations and where the soil is exposed, for example, roads, skid trails, fire lanes, and log handling areas. Forests that are abused by fire or overgrazing are also subject to erosion. The ratings for the erosion hazard are based on the percent of the slope and on the erosion factor K shown in table 16. A rating of *slight* indicates that no particular measures to prevent erosion are needed under ordinary conditions. A rating of *moderate* indicates that erosion control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

The proper construction and maintenance of roads, trails, landings, and fire lanes will help overcome the erosion hazard.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that equipment use normally is not restricted either in kind of equipment that can be used or time of year because of soil factors.

If soil wetness is a factor, equipment use can be restricted for a period not to exceed 2 months. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If soil wetness is a factor, equipment use is restricted for 2 to 6 months. A rating of *severe* indicates that equipment use is severely restricted either in kind of equipment or season of use. If soil wetness is a factor, equipment use is restricted for more than 6 months.

Choosing the most suitable equipment and timing harvesting and other management operations to avoid seasonal limitations help overcome the equipment limitation.

Seedling mortality refers to the probability of death of naturally occuring or planted tree seedlings as influenced by kinds of soil or topographic conditions. The factors considered in rating the soils for seedling mortality are texture of the surface layer, depth and duration of the water table, rock fragments in the surface layer, rooting depth, and aspect of the slope. A rating of *slight* indicates that under usual conditions the expected mortality is less than 25 percent. A rating of *moderate* indicates that the expected mortality is 25 to 50 percent. Extra precautions are advisable. A rating of *severe* indicates that the expected mortality is more than 50 percent. Extra precautions are important. Replanting may be necessary.

The use of special planting stock and special site preparation, such as bedding, furrowing, or surface drainage, can help reduce seedling mortality.

Windthrow hazard is the likelihood of trees being uprooted (tipped over) by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions are a seasonal high water table and bedrock or a fragipan or other limiting layer. A rating of *slight* indicates that normally no trees are blown down by the wind. Strong winds may break trees but do not uproot them. A rating of *moderate* indicates that moderate or strong winds occasionally blow down a few trees during periods of soil wetness. A rating of *severe* indicates that moderate or strong winds may blow down many trees during periods of soil wetness.

The use of specialized equipment that does not damage surficial root systems during partial cutting operations can help reduce windthrow. Care in thinning or no thinning also can help reduce windthrow.

The *potential productivity* of the *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in 50 years. The site index applies to fully stocked, even-aged, unmanaged stands. Common trees are those that generally are growing on the soil.

The *productivity class*, a number, represents an expected volume produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced on a fully stocked, even-aged, unmanaged stand. One cubic meter per hectare equals 14.3 cubic feet per acre.

The first tree species listed under common trees for a soil is the indicator species for that soil. The indicator species is the species that is common in the area and is generally the most productive on the soil. The productivity class of the indicator species is the number used for the ordination symbol.

Trees to plant are those that are suited to the soil and are planted for commercial wood production.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are tall fescue, timothy, bromegrass, red clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggar-ticks, furdock, and ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, tulip-poplar, red maple, birch, cherry, maple, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are silky dogwood, American hazel, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, yew, cedar, and hemlock.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland

plants are smartweed, wild millet, cattail, burreed, arrowhead, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, swamps, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the

year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive

or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain

sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the

root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a

percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

Some soils in table 17 are assigned to two hydrologic soil groups. Dual grouping is used for one of two reasons: (1) Some soils have a seasonal high water table but can be drained. In this instance the first letter applies to the drained condition of the soil and the second letter to the undrained condition. (2) In some soils that are less than 20 inches deep to bedrock, the first letter applies to areas where the bedrock is cracked and pervious and the second letter to areas where the bedrock is impervious or where exposed bedrock makes up more than 25 percent of the surface of the soil.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable period of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional, common,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is a 5 to 50 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year). *Common* is used when classification as occasional or frequent does not affect interpretations. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. November-May, for example, means that flooding can occur during the period November through May. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely, grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table, that is, *perched, artesian,* or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally

below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*10*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludults (*Hapl*, meaning minimal horizonation, plus *udults*, the suborder of the Ultisols that have an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludults.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*7*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*10*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Albrights Series

The soils of the Albrights series are fine-loamy, mixed, mesic Aquic Fragiudalfs. These soils are very deep and moderately well drained and somewhat poorly drained. They are in broad valleys and in drainageways. They formed in colluvium from red, acid shale and sandstone. Slope is 3 to 15 percent.

Albrights soils are adjacent on the landscape to deep, well drained Leck Kill and Meckesville soils and deep, poorly drained Brinkerton soils.

Typical pedon of Albrights silt loam, 3 to 8 percent slopes, in Norwich Township, 4 miles south of Crosby, in

Sackett Hollow, 300 yards east of Pennsylvania Route 46, 20 feet north of Township Route 373, in a cultivated field:

Ap—0 to 8 inches; dark brown (7.5YR 4/4) silt loam; weak fine granular structure; friable, nonsticky and nonplastic; 5 percent rock fragments; strongly acid; abrupt smooth boundary.

BE—8 to 13 inches; reddish brown (5YR 5/4) silt loam; weak medium subangular blocky structure; friable, sticky and plastic; 5 percent rock fragments; strongly acid; clear wavy boundary.

Bt—13 to 19 inches; reddish brown (5YR 5/4) silt loam; moderate medium subangular blocky structure; friable, sticky and plastic; 5 percent rock fragments; common faint clay films on faces of peds and lining pores; 5 percent rock fragments; strongly acid; gradual wavy boundary.

Btx1—19 to 35 inches; reddish brown (5YR 5/4) loam; common medium distinct gray (5YR 5/1) mottles; moderate coarse prismatic structure; firm and brittle, slightly sticky and slightly plastic; 5 percent rock fragments; common faint gray (10YR 5/1) clay films on pores and faces of peds; strongly acid; gradual wavy boundary.

Btx2—35 to 48 inches; reddish brown (5YR 5/4) loam; common medium distinct gray (N5/0) mottles; moderate very coarse prismatic structure; firm and brittle, slightly sticky and slightly plastic; 10 percent rock fragments; common faint gray (10YR 5/1) clay films on faces of peds; moderately acid; clear wavy boundary.

C—48 to 70 inches; reddish brown (2.5YR 4/4) channery clay loam; massive; firm, slightly sticky and slightly plastic; 25 percent rock fragments; moderately acid.

The solum ranges from 40 to 65 inches in thickness. Depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 18 to 30 inches. Rock fragments make up 0 to 30 percent of the upper part of the solum and 5 to 30 percent of the lower part and the C horizon. In unlimed areas reaction ranges from extremely acid to strongly acid in the upper part of the solum and from very strongly acid to moderately acid in the lower part and the C horizon.

The Ap horizon has hue of 7.5YR to 5YR, value of 3 or 4, and chroma of 2 to 4.

The BE and Bt horizons have hue of 5YR to 2.5YR, value of 4 or 5, and chroma of 3 to 6. Fine earth texture ranges from silt loam to clay loam.

The Bt horizon has hue of 5YR to 2.5YR, value of 4 or 5, and chroma of 2 to 6. Fine earth texture ranges from loam to clay loam.

The C horizon has hue of 2.5YR to 5YR, value of 4 or 5, and chroma of 2 to 6. Fine earth texture is loam to clay loam.

Atkins Series

The soils of the Atkins series are fine-loamy, mixed, acid, mesic Typic Fluvaquents. These soils are very deep and poorly drained. They are on flood plains. These soils formed in alluvium from acid sandstone and shale. Slope ranges from 0 to 3 percent.

Atkins soils are adjacent on the landscape to very deep, well drained Barbour and Pope soils, very deep moderately well drained Philo soils, very deep, moderately well drained and somewhat poorly drained Basher soils, and very deep, very poorly drained Palms soils.

Typical pedon of Atkins silt loam, in Foster Township, 1.8 miles east of Bradford city line, 500 feet downstream from the junction of the stream draining Totten Hollow and Kendall Creek, in a cultivated field:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; common fine distinct strong brown (7.5YR 5/6) mottles; weak fine granular structure; friable, nonsticky and nonplastic; moderately acid; abrupt smooth boundary.

Bg1—7 to 14 inches; dark gray (10YR 4/1) silt loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable, nonsticky and nonplastic; strongly acid; gradual wavy boundary.

Bg2—14 to 35 inches; dark gray (10YR 4/1) loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak medium subangular blocky structure; friable, nonsticky and nonplastic; strongly acid; clear wavy boundary.

Cg—35 to 65 inches; gray (10YR 5/1) gravelly sandy loam; massive; loose, nonsticky and nonplastic; 30 percent gravel; strongly acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 60 inches. The content of rock fragments ranges from 0 to 20 percent in the solum and from 0 to 30 percent in the C horizon. In unlimed areas reaction is strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2.

The B horizon is neutral or has hue of 10YR or 2.5Y; value is 4 to 6, and chroma is 0 or 1. Fine earth texture is dominantly silt loam or loam, but the range is silty clay loam to fine sandy loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 to 6. Fine earth texture ranges from silty clay loam to sandy loam.

Barbour Series

The soils of the Barbour series are coarse-loamy over sandy or sandy-skeletal, mixed, mesic Fluventic Dystrochrepts. These soils are very deep, well drained

soils. They are on flood plains. They formed in alluvium from red sandstone and shale. Slope ranges from 0 to 3 percent.

Barbour soils are adjacent on the landscape to very deep, moderately well drained and somewhat poorly drained Basher soils and very deep, poorly drained Atkins soils.

Typical pedon of Barbour loam, in Annin Township, 4.1 miles east of Sartwell, along Annin Creek, 0.7 mile west of the junction of Township Routes 422 and 430, 201 feet south of Township Route 422, in a pasture:

Ap—0 to 7 inches; dark reddish brown (5YR 3/3) loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; moderately acid; clear wavy boundary.

Bw—7 to 21 inches; reddish brown (5YR 5/4) loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; moderately acid; clear wavy boundary.

C1—21 to 29 inches; reddish brown (5YR 5/4) gravelly loam; massive; friable, nonsticky and nonplastic; 20 percent gravel; moderately acid; clear wavy boundary.

2C2—29 to 60 inches; reddish brown (5YR 5/4) very gravelly loamy sand; massive; friable, nonsticky and nonplastic; 60 percent gravel; moderately acid.

The solum ranges from 18 to 40 inches in thickness. Depth to the 2C horizon ranges from 20 to 40 inches. Depth to bedrock is more than 60 inches. Rock fragments range from 0 to 20 percent by volume above the 2C horizon and from 35 to 60 percent in the 2C horizon. Reaction ranges from moderately acid to very strongly acid in the solum and from strongly acid to slightly acid in the substratum.

The Ap horizon has hue of 7.5YR or 5YR, value of 3 or 4, and chroma of 2 to 4.

The B horizon has hue of 7.5YR or 5YR, value of 4 to 5, and chroma of 4. Fine earth texture ranges from fine sandy loam to silt loam.

The C horizon has hue of 7.5YR or 5YR, value of 4 to 5, and chroma of 4. Fine earth texture ranges from fine sandy loam to silt loam.

The 2C horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 3 to 6. Fine earth texture is loamy sand or loamy fine sand.

Basher Series

The soils of the Basher series are coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts. These soils are very deep and moderately well drained and somewhat poorly drained. They are on flood plains. They formed in alluvium from red, acid sandstone and shale. Slope ranges from 0 to 3 percent.

Basher soils are adjacent on the landscape to very deep, well drained Barbour soils and very deep, poorly drained Atkins soils.

Typical pedon of Basher silt loam, in Foster Township, along Kendall Run, 0.25 mile east of Bradford City line, 1,100 feet north of Pennsylvania Route 46 on north bank of creek, in a pasture:

Ap—0 to 6 inches; dark brown (7.5YR 3/2) silt loam; weak medium granular structure; very friable, nonsticky and nonplastic; very strongly acid; abrupt smooth boundary.

Bw—6 to 20 inches; brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; friable, nonsticky and nonplastic; very strongly acid; gradual wavy boundary.

C1—20 to 32 inches; brown (7.5YR 5/4) fine sandy loam; many medium distinct grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) mottles; massive; friable, nonsticky and nonplastic; very strongly acid; clear wavy boundary.

C2—32 to 41 inches; brown (7.5YR 5/2) fine sandy loam; few fine and medium distinct yellowish brown (10YR 5/6) mottles; massive; friable, nonsticky and nonplastic; strongly acid; clear wavy boundary.

2C3—41 to 73 inches; brown (7.5YR 5/2) very gravelly loamy sand; massive; friable, nonsticky and nonplastic; 50 percent gravel; very strongly acid.

The solum ranges from 20 to 40 inches in thickness. Depth to low chroma mottling ranges from 15 to 20 inches. Depth to contrasting textures is 40 inches or more. Depth to bedrock is more than 60 inches. The content of gravel in the horizons above the 2C horizon ranges from 0 to 20 percent and in the 2C horizon ranges from 20 to 60 percent. In unlimed areas reaction ranges from moderately acid to very strongly acid in the solum and from very strongly acid to slightly acid in the substratum.

The Ap horizon has hue of 5YR or 7.5YR, value of 3 or 4, and chroma of 2 to 4.

The B horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 3 to 6. Fine earth texture is loam, silt loam, or fine sandy loam.

The C horizon is 7.5YR or 5YR, chroma of 4 or 5, and value of 2 to 4. Fine earth texture is silt loam or fine sandy loam above a depth of 40 inches and sand or loamy sand below that depth.

Braceville Series

The soils of the Braceville series are coarse-loamy, mixed, mesic Typic Fragiochrepts. These soils are very deep and moderately well drained and somewhat poorly drained. They are on terraces. They formed in brownish alluvium. Slope is 3 to 8 percent.

Braceville soils are adjacent on the landscape to very deep, somewhat poorly drained and poorly drained Rexford soils.

Typical pedon of Braceville silt loam, 3 to 8 percent slopes, in Keating Township, 1.2 miles west of Farmers Valley, 1,700 feet north of the junction of Township Routes 349 and 350, 10 feet west of Township Route 350, in a cultivated field:

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; friable, nonsticky and nonplastic; moderately acid; abrupt smooth boundary.

Bw1—7 to 14 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; firm, slightly sticky and slightly plastic; 5 percent gravel; moderately acid; clear wavy boundary.

Bw2—14 to 18 inches; brown (10YR 5/3) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm, slightly sticky and slightly plastic; 5 percent gravel; moderately acid; clear wavy boundary.

Bx—18 to 37 inches; yellowish brown (10YR 5/4) gravelly silt loam; common medium distinct gray (10YR 5/1) mottles; moderate very coarse prismatic structure parting to weak coarse platy; firm and brittle, nonsticky and nonplastic; 20 percent gravel; moderately acid; clear wavy boundary.

C—37 to 63 inches; yellowish brown (10YR 5/4) extremely gravelly loamy sand; massive; friable, nonsticky and nonplastic; 60 percent gravel.

The solum ranges from 30 to 55 inches in thickness. Depth to bedrock is more than 60 inches. Depth to the fragipan is 15 to 30 inches. Depth to mottling is 12 to 30 inches. Gravel makes up 0 to 10 percent of the upper part of the solum and 20 to 40 percent of the lower part. In unlimed areas reaction ranges from very strongly acid to moderately acid above the Bx horizon and from strongly acid to slightly acid in the Bx and C horizons.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Fine earth texture is loam, sandy loam, or silt loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Fine earth texture is loam, sandy loam, or silt loam.

The C horizon has hue of 5YR to 2.5Y, value of 4 or 5, and chroma of 4 to 6. Fine earth texture is loamy sand or sandy loam.

Brinkerton Series

The soils of the Brinkerton series are fine-silty, mixed, mesic Typic Fragiaqualfs. These soils are very deep and poorly drained. They are in drainageways and at the base of the steeper slopes and the concave basins in broad, upland areas. They formed in colluvium from acid shale and siltstone. Slope ranges from 0 to 8 percent.

Brinkerton soils are on the landscape near very deep, moderately well drained and somewhat poorly drained Albrights soils, very deep, moderately well drained to somewhat poorly drained Buchanan soils, and deep and very deep, moderately well drained Cookport soils.

Typical pedon of Brinkerton silt loam, 3 to 8 percent slopes, in Ceres Township, 1.7 miles southwest of Ceres, 550 feet south of Legislative Route 42029 and 1,200 feet west of Legislative Route 42028, in a pasture:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak medium granular structure; friable, nonsticky and nonplastic; moderately acid; abrupt smooth boundary.

Btg1—9 to 15 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; firm, sticky and plastic; common, prominent clay films on faces of peds; strongly acid; gradual wavy boundary.

Btg2—15 to 20 inches; gray (10YR 5/1) silty clay loam; common medium distinct reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky structure; firm, sticky and plastic; common, prominent clay films on faces of peds; strongly acid; clear wavy boundary.

Bxg1—20 to 26 inches; gray (10YR 5/1) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium platy; firm and brittle, sticky and plastic; many prominent clay films on faces of peds; strongly acid; gradual wavy boundary.

Bxg2—26 to 33 inches; gray (10YR 6/1) silt loam; moderate medium distinct yellowish brown (10YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate thick platy; firm and brittle, sticky and plastic; many prominent clay films on faces of peds; moderately acid; gradual wavy boundary.

Bxg3—33 to 44 inches; gray (10YR 6/1) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure parting to weak thick platy; firm and brittle, slightly sticky and slightly plastic; common faint clay films on faces of peds; moderately acid; clear wavy boundary.

Cg—44 to 60 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct yellowish brown (10YR 5/4) mottles; weak very coarse prismatic structure; firm, slightly sticky and slightly plastic; 10 percent rock fragments; moderately acid.

The solum ranges from 40 to 50 inches in thickness. Depth to the fragipan ranges from 16 to 28 inches.

Depth to bedrock is more than 60 inches. Content of rock fragments ranges from 0 to 10 percent in the A and Btg horizons, from 0 to 15 percent in the Bxg horizon, and from 10 to 20 percent in the C horizon. Reaction ranges from very strongly acid to moderately acid in the solum and from strongly acid to slightly acid in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The Btg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. Fine earth texture ranges from silt loam to silty clay loam.

The Bxg horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. Fine earth texture ranges from silt loam to silty clay loam.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4. Fine earth texture ranges from silt loam to silty clay loam.

Buchanan Series

The soils of the Buchanan series are fine-loamy, mixed, mesic Aquic Fragiudults. These soils are very deep and moderately well drained to somewhat poorly drained. They are in broad valleys and drainageways. They formed in colluvium from gray sandstone and shale. Slope ranges from 0 to 25 percent.

Buchanan soils are adjacent on the landscape to deep, well drained Hartleton soils, deep and very deep, moderately well drained Cookport soils, very deep, somewhat poorly drained Cavode soils, and very deep, poorly drained Brinkerton soils. Buchanan soils have a thicker solum than Cookport soils, and are deeper than 72 inches to bedrock.

Typical pedon of Buchanan silt loam, 8 to 15 percent slopes, in Norwich township, 2.2 miles east of Crosby, 200 yards east of house, 6 feet south of Legislative Route 42017, in a hayfield:

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; 5 percent rock fragments; strongly acid; abrupt smooth boundary.

Bt1—8 to 13 inches; yellowish brown (10YR 5/4) silt loam; few coarse faint pale brown (10YR 6/3) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 5 percent rock fragments; very strongly acid; gradual wavy boundary.

Bt2—13 to 26 inches; yellowish brown (10YR 5/4) clay loam; many coarse prominent gray (10YR 6/1) and strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; firm, slightly sticky and slightly plastic; common faint clay films on ped faces and in pores; 10 percent rock fragments; very strongly acid; gradual wavy boundary.

Bx1—26 to 37 inches; brown (10YR 5/3) gravelly clay loam; many coarse prominent gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; firm and brittle, slightly sticky and slightly plastic; common distinct clay films in pores and on ped faces; 20 percent rock fragments; very strongly acid; clear wavy boundary.

Bx2—37 to 43 inches; dark brown (10YR 4/3) gravelly clay loam; many medium and coarse light yellowish brown (10YR 6/4) mottles; moderate coarse prismatic structure parting to medium and coarse subangular blocky; firm and brittle, slightly sticky and slightly plastic; common distinct clay films in pores and on ped faces; 30 percent rock fragments; strongly acid; gradual wavy boundary.

C—43 to 83 inches; dark brown (10YR 4/3) gravelly silt loam; many coarse faint brown (10YR 5/3) mottles; massive; firm, slightly sticky and slightly plastic; 30 percent rock fragments; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 20 to 36 inches. Rock fragments make up 5 to 15 percent in the A and E horizons, from 5 to 25 percent in the Bt horizon, from 10 to 30 percent in the Bx horizon, and from 10 to 40 percent in the C horizon. In unlimed areas reaction ranges from extremely acid to moderately acid throughout.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 1 to 4.

Some pedons have an E horizon that has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. Fine earth texture is silt loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. Fine earth texture is silt loam or clay loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 4 to 7, and chroma of 2 to 6. Fine earth texture is loam, silt loam, or clay loam.

The C horizon has hue of 2.5Y to 7.5YR, value of 4 to 7, and chroma of 2 to 6. Fine earth texture is silt loam to sandy clay loam.

Cavode Series

The soils of the Cavode series are clayey, mixed, mesic Aeric Ochraquults. These soils are deep and very deep and somewhat poorly drained. They are on uplands. They formed in residuum from acid shale. Slope ranges from 0 to 8 percent.

Cavode soils are adjacent on the landscape to very deep, moderately well drained and somewhat poorly drained Buchanan soils, very deep, moderately well drained Wharton soils, and deep, moderately well drained Cookport soils.

Typical pedon of Cavode silt loam, 3 to 8 percent slopes, in Hamlin Township, 2.5 miles southeast of Mount Jewett, 900 feet west of Legislative Route 42004,

100 feet south of a private road to an old, clay stripmine, in woodland:

A1—0 to 1 inch; very dark, grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable, nonsticky and nonplastic; very strongly acid; abrupt smooth boundary.
E—1 to 7 inches; yellowish brown (10YR 5/4) silt loam; weak medium granular structure; friable, nonsticky and nonplastic; very strongly acid; clear wavy boundary.
Bt—7 to 13 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm, sticky and plastic; common, faint clay films on faces of peds; 5 percent rock fragments; very strongly acid; clear wavy boundary.
Btg1—13 to 22 inches; gray (10YR 6/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm, sticky and plastic; common, faint clay films on faces of peds; 5 percent rock fragments; very strongly acid; clear wavy boundary.
Btg2—22 to 35 inches; light brownish gray (10YR 6/2) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure; firm, sticky and plastic; common faint gray (10YR 6/1) clay films on faces of peds; 5 percent rock fragments; very strongly acid; clear wavy boundary.
Btg3—35 to 47 inches; gray (10YR 5/1) silty clay loam; common medium distinct brown (10YR 5/3) mottles; moderate medium prismatic structure parting to moderate medium platy; firm, sticky and plastic; common, faint clay films on faces of peds; 5 percent rock fragments; very strongly acid; clear wavy boundary.
Cg—47 to 71 inches; light brownish gray (10YR 6/2) very channery silty clay loam; massive; firm, slightly sticky and slightly plastic; 50 percent rock fragments; very strongly acid; clear wavy boundary.
R—71 inches; light brownish gray (10YR 6/2) clay shale.

The solum ranges from 36 to 60 inches in thickness. Depth to bedrock ranges from 50 to 72 inches. Content of rock fragments ranges from 0 to 10 percent in the upper part of the solum, from 5 to 15 percent in the lower part of the solum, and from 10 to 80 percent in the C horizon. Reaction is very strongly acid or strongly acid throughout.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4.

The E horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Fine earth texture is silt loam to silty clay.

The Btg horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 2. Fine earth texture is silty clay loam or silty clay.

The C horizon commonly has hue of 10YR or 2.5YR, value of 4 to 6, and chroma of 1 to 4. Fine earth texture ranges from silt loam to silty clay loam.

Chenango Series

The soils of the Chenango series are loamy-skeletal, mixed, mesic Typic Dystrochrepts. These soils are very deep and well drained. They are on stream terraces. They formed in brown alluvium. Slope is 3 to 8 percent.

Chenango soils are adjacent on the landscape to very deep, moderately well drained and somewhat poorly drained Braceville soils and very deep, somewhat poorly to poorly drained Rexford soils.

Typical pedon of Chenango gravelly loam, 3 to 8 percent slopes, in Ceres Township, 1.3 miles west of Shinglehouse, 3.0 miles east of Ceres, 1,900 feet south of the intersection of the stream draining Raub Hollow and Township Route 437, in a cultivated field:

Ap—0 to 7 inches; dark brown (10YR 3/3) gravelly loam; weak fine granular structure; very friable, nonsticky and nonplastic; 20 percent gravel; moderately acid; abrupt smooth boundary.
Bw1—7 to 14 inches; yellowish brown (10YR 5/6) gravelly loam; weak fine subangular blocky structure; very friable, nonsticky and nonplastic; 25 percent gravel; strongly acid; gradual wavy boundary.
Bw2—14 to 19 inches; yellowish brown (10YR 5/6) gravelly loam; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; 30 percent gravel; strongly acid; gradual wavy boundary.
Bw3—19 to 31 inches; yellowish brown (10YR 5/6) very gravelly loam; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; 45 percent gravel; strongly acid; clear wavy boundary.
C—31 to 80 inches; brown (10YR 5/3) extremely gravelly loamy sand; single grain; loose, nonsticky and nonplastic; 70 percent gravel; moderately acid.

The solum ranges from 24 to 40 inches. Depth to bedrock is more than 60 inches.

Gravel makes up 15 to 30 percent of the Ap horizon, 20 to 60 percent of the B horizon, and 40 to 70 percent of the C horizon. Reaction is very strongly to moderately acid in the A and B horizons and strongly acid to neutral in the C horizon.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Fine earth texture ranges from silt loam to sandy loam.

The C horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 2 to 4. Fine earth texture ranges from loamy fine sand to coarse sand.

Clymer Series

The soils of the Clymer series are fine-loamy, mixed, mesic Typic Hapludults. These soils are deep and very deep, well drained soils on uplands. They formed in residuum from sandstone and siltstone.

Clymer soils are adjacent on the landscape to deep, moderately well drained Cookport soils and deep, well drained Hazleton soils.

Representative profile of Clymer loam, 3 to 8 percent slopes, in Sergeant Township, 110 feet west of Township Route 321, along Tennessee Gas Pipeline, 0.4 mile northwest of the junction of Township Route 321 and Pennsylvania Route 146, approximately 2 miles north of Clermont:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; very friable, nonsticky and nonplastic; 10 percent rock fragments; extremely acid; abrupt smooth boundary.
E1—3 to 5 inches; brown (10YR 5/3) channery sandy loam; weak fine granular structure; friable, nonsticky and nonplastic; 15 percent rock fragments; extremely acid; abrupt smooth boundary.
E2—5 to 10 inches; yellowish brown (10YR 5/6) channery loam; moderate fine granular structure; very friable, nonsticky and nonplastic; 30 percent rock fragments; extremely acid; gradual wavy boundary.
Bt1—10 to 19 inches; yellowish brown (10YR 5/4) channery loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; common faint clay films on ped faces; 20 percent rock fragments; extremely acid; gradual wavy boundary.
Bt2—19 to 31 inches; yellowish brown (10YR 5/4) channery loam; moderate medium and coarse subangular blocky structure; friable, slightly sticky and plastic; common faint clay films on ped faces; 15 percent rock fragments; extremely acid; gradual wavy boundary.
C—31 to 48 inches; yellowish brown (10YR 5/4) extremely channery loam; massive; friable, nonsticky and nonplastic; 70 percent rock fragments; extremely acid; clear wavy boundary.
R—48 inches; grayish brown (10YR 5/2) sandstone.

The solum ranges from 24 to 36 inches. Depth to bedrock ranges from 42 to 84 inches. Rock fragments make up 5 to 35 percent of the solum and 40 to 80 percent of the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid throughout.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 to 3.

The E horizon has hue of 10YR, value of 5, and chroma of 3 to 6. Fine earth texture is loam or sandy loam.

The B horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. Fine earth texture ranges from loam to clay loam.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 4 to 6. Fine earth texture ranges from loam to sandy loam.

Cookport Series

The soils of the Cookport series are fine-loamy, mixed, mesic Aquic Fragiudults. These soils are deep and very deep, moderately well drained soils on uplands. They formed in residuum from interbedded sandstone and shale. Slope ranges from 0 to 25 percent.

Cookport soils are adjacent on the landscape to deep, well drained Hartleton and Hazleton soils, very deep, moderately well drained to somewhat poorly drained Buchanan soils, deep and very deep, moderately well drained Wharton soils, very deep, somewhat poorly drained Cavode soils, and very deep, poorly drained Brinkerton soils.

Typical pedon of Cookport loam, 3 to 8 percent slopes, 350 feet north of Pennsylvania Route 59, 3.7 miles west of Smethport, 0.9 mile east of Ormsby, in woodland:

Oe—1 inch to 0; black (N2/0) partly decomposed organic matter; abrupt smooth boundary.
A—0 to 3 inches; very dark grayish brown (10YR 3/2) loam; weak fine granular structure; friable, nonsticky and nonplastic; 5 percent rock fragments; very strongly acid; gradual wavy boundary.
E—3 to 9 inches; yellowish brown (10YR 5/4) loam; moderate medium granular structure; friable, nonsticky and nonplastic; 5 percent rock fragments; very strongly acid; clear wavy boundary.
Bt1—9 to 16 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; common faint clay films; 5 percent rock fragments; very strongly acid; clear wavy boundary.
Bt2—16 to 21 inches; yellowish brown (10YR 5/4) clay loam; common medium distinct light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; common faint clay films; 10 percent rock fragments; very strongly acid; clear wavy boundary.
Bx—21 to 39 inches; yellowish brown (10YR 5/4) loam; common medium distinct gray (10YR 6/1) mottles; moderate coarse prismatic structure; firm and brittle, slightly sticky and slightly plastic; common faint clay films; 10 percent rock fragments; very strongly acid; clear wavy boundary.

C—39 to 45 inches; brown (10YR 5/3) gravelly sandy loam; common medium distinct gray (10YR 6/1) mottles; massive; firm, nonsticky and nonplastic; 20 percent rock fragments; very strongly acid; abrupt wavy boundary.
R—45 inches; gray sandstone bedrock.

The solum ranges from 30 to 40 inches in thickness. Depth to bedrock ranges from 42 to 72 inches. Depth to the fragipan ranges from 16 to 27 inches. Rock fragments make up 5 to 30 percent of the solum. In unlimed areas reaction ranges from strongly acid to extremely acid.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3.

The E horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. Fine earth texture is silt loam or loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. Fine earth texture ranges from loam and sandy loam to clay loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 8. Fine earth texture ranges from sandy loam to clay loam.

The C horizon has hue of 7.5YR to 2.5Y, value of 4 or 5, and chroma of 2 to 4. Fine earth texture is loam or sandy loam.

Hartleton Series

The soils of the Hartleton series are loamy-skeletal, mixed, mesic Typic Hapludults. These soils are deep and well drained. They are on hillsides, benches, and hilltops. They formed in residuum from gray siltstone and shale. Slope ranges from 3 to 60 percent.

Hartleton soils are adjacent on the landscape to very deep, moderately well drained and somewhat poorly drained Buchanan soils, very deep and deep, moderately well drained Wharton and Cookport soils, and deep, well drained Hazleton soils.

Typical pedon of Hartleton channery silt loam, in an area of Hartleton and Buchanan soils, 25 to 60 percent slopes, in Corydon Township, 12 miles west of Bradford, 0.8 mile north of the intersection of Township Route 326 and Pennsylvania Route 346, 5 feet east of Township Route 326, in a wooded area:

A—0 to 1 inch; dark yellowish brown (10YR 4/4) channery silt loam; weak fine granular structure; friable, nonsticky and nonplastic; 25 percent rock fragments; very strongly acid; abrupt smooth boundary.
E—1 to 11 inches; yellowish brown (10YR 5/4) channery silt loam; weak fine granular structure; friable, nonsticky and nonplastic; 25 percent rock fragments; very strongly acid; clear wavy boundary.
Bt1—11 to 19 inches; yellowish brown (10YR 5/4) very channery silt loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 35 percent rock fragments; common faint clay films; very strongly acid; gradual wavy boundary.
Bt2—19 to 32 inches; yellowish brown (10YR 5/4) very channery silt loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; 50 percent rock fragments; common faint clay films; very strongly acid; gradual wavy boundary.
BC—32 to 39 inches; yellowish brown (10YR 5/4) extremely channery silt loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; 65 percent rock fragments; very strongly acid; clear wavy boundary.
C—39 to 57 inches; yellowish brown (10YR 5/4) extremely channery silt loam; massive; friable, nonsticky and nonplastic; 85 percent rock fragments; very strongly acid; clear wavy boundary.
R—57 inches; siltstone bedrock.

The solum ranges from 30 to 40 inches in thickness. Depth to bedrock ranges from 40 to 60 inches. Rock fragments range from 15 to 40 percent, by volume, in the A and E horizons, from 25 to 70 percent in the B horizon, and from 50 to 90 percent in the C horizon. In unlimed areas reaction ranges from strongly acid to very strongly acid.

The A horizon has hue of 10YR, value of 2 to 4, and chroma of 2 to 4.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6. Fine earth texture is silt loam or loam.

The B horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. Fine earth texture ranges from loam to silty clay loam.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. Fine earth texture is silt loam or loam.

Hazleton Series

The soils of the Hazleton series are loamy-skeletal, mixed, mesic Typic Dystrochrepts. These soils are deep and well drained. They are on nearly level to moderately steep, convex hillsides and hilltops. They formed in residuum from gray sandstone. Slope ranges from 0 to 25 percent.

Hazleton soils are adjacent on the landscape to deep, well drained Clymer and Hartleton soils and deep and very deep, moderately well drained Cookport soils.

Representative profile of Hazleton channery loam, 8 to 25 percent slopes, very stony, in Keating Township, about 3 miles north of Smethport, 3,800 feet east of the lake in Elk Lick Boy Scout Camp, 2,400 feet south of Township Route 349, in woodland:

A—0 to 3 inches; very dark grayish brown (10YR 3/2) channery loam; weak fine granular structure; friable,

nonsticky and nonplastic; 20 percent rock fragments; very strongly acid; clear wavy boundary.
E—3 to 6 inches; brown (10YR 5/3) channery sandy loam; moderate fine granular structure; friable, nonsticky and nonplastic; 20 percent rock fragments; extremely acid; clear smooth boundary.
Bw1—6 to 12 inches; strong brown (7.5YR 5/6) channery loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; 30 percent rock fragments; very strongly acid; gradual wavy boundary.
Bw2—12 to 22 inches; dark brown (10YR 4/3) very channery sandy loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; 40 percent rock fragments; very strongly acid; gradual wavy boundary.
Bw3—22 to 34 inches; dark brown (10YR 4/3) extremely channery sandy loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; 60 percent rock fragments; very strongly acid; gradual wavy boundary.
C—34 to 43 inches; dark brown (10YR 4/3) extremely channery sandy loam; massive; friable, nonsticky and nonplastic; 80 percent rock fragments; very strongly acid; clear irregular boundary.
R—43 inches; sandstone bedrock.

The solum ranges from 26 to 40 inches in thickness. Depth to bedrock is 40 to 60 inches. Rock fragments range from 15 to 60 percent, by volume, in the solum and from 50 to 80 percent in the C horizon. In unlimed areas reaction is strongly acid to extremely acid throughout.

The A horizon has hue of 10YR, value of 2 or 3, and chroma of 1 or 2.

The E horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 4.

The Bw horizon has hue of 10YR or 7.5YR, value of 3 to 6, and chroma of 3 to 6. Fine earth texture is loam or sandy loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 8. Fine earth texture is loam to loamy sand.

Leck Kill Series

The soils of the Leck Kill series are fine-loamy, mixed, mesic Typic Hapludults. These soils are deep and well drained. They are on hillsides and hilltops. They formed in residuum from reddish shale and siltstone. Slope ranges from 3 to 50 percent.

Leck Kill soils are adjacent on the landscape to very deep, well drained Meckesville soils and very deep, moderately well drained and somewhat poorly drained Albrights soils.

Typical profile of Leck Kill channery silt loam, 3 to 8 percent slopes, in Annin Township, 6.3 miles north of Port Allegany, 25 feet north of the intersection of Township Routes 428 and 424, in a cultivated field:

Ap—0 to 6 inches; dark brown (7.5YR 3/2) channery silt loam; weak fine granular structure; friable, nonsticky and nonplastic; 15 percent rock fragments; very strongly acid; abrupt smooth boundary.
BE—6 to 14 inches; dark reddish brown (5YR 3/4) channery silt loam; weak fine subangular blocky structure; friable, slightly sticky and slightly plastic; few faint clay films; 15 percent rock fragments; very strongly acid; clear wavy boundary.
Bt—14 to 26 inches; dark reddish brown (2.5YR 3/4) channery silt loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; common faint clay films; 20 percent rock fragments; very strongly acid; gradual wavy boundary.
C—26 to 44 inches; dark reddish brown (2.5YR 3/4) extremely channery silt loam; massive; friable, nonsticky and nonplastic; 60 percent rock fragments; very strongly acid; clear wavy boundary.
R—44 inches; dusky red shale bedrock.

The solum ranges from 24 to 36 inches in thickness. Depth to bedrock is 42 to 60 inches. Rock fragments make up 15 to 25 percent of the A horizon, 15 to 35 percent of the B horizon, and 60 to 80 percent of the C horizon. In unlimed areas reaction ranges from very strongly acid to moderately acid throughout.

The Ap horizon has hue of 7.5YR or 2.5YR, value of 3 or 4, and chroma of 2 to 4.

The B horizon has hue of 5YR or 2.5YR, value of 3 to 5, and chroma of 4 to 6. Fine earth texture ranges from silt loam to silty clay loam.

The C horizon has hue of 5YR or 2.5YR, value of 3 to 5, and chroma of 4 to 6. Fine earth texture ranges from silt loam to clay loam.

Meckesville Series

The soils of the Meckesville series are fine-loamy, mixed, mesic Typic Fragiudults. These soils are very deep and well drained. They are on the lower slopes. They formed in colluvium from red siltstone, shale, and sandstone. Slope is 15 to 25 percent.

Meckesville soils are adjacent on the landscape to deep, well drained Leck Kill soils and very deep, moderately well drained and somewhat poorly drained Albrights soils.

Typical pedon of Meckesville channery silt loam, 15 to 25 percent slopes, in Smethport, northeast of the corner of Hamlin and King Streets, 100 feet north of King Street, 200 feet east of Hamlin Street, in a hayfield:

Ap—0 to 9 inches; dark reddish gray (5YR 4/2) channery silt loam; weak fine granular structure;

friable, nonsticky and nonplastic; 25 percent rock fragments; moderately acid; abrupt smooth boundary.

Bt1—9 to 15 inches; reddish brown (5YR 5/4) channery silt loam; moderate fine subangular blocky structure; friable, sticky and plastic; faint continuous clay films; 20 percent rock fragments; moderately acid; clear wavy boundary.

Bt2—15 to 24 inches; reddish brown (5YR 5/4) channery silty clay loam; moderate medium subangular blocky structure; friable, sticky and plastic; common faint clay films; 20 percent rock fragments; moderately acid; clear wavy boundary.

Bx—24 to 51 inches; reddish brown (5YR 5/4) channery silty clay loam; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm and brittle, sticky and plastic; common faint clay films; 30 percent rock fragments; strongly acid; abrupt smooth boundary.

2C1—51 to 56 inches; reddish brown (2.5YR 4/4) extremely channery silty clay loam; massive; friable, sticky and plastic; 70 percent rock fragments; strongly acid; abrupt smooth boundary.

3C2—56 to 66 inches; reddish brown (5YR 5/4) extremely channery silty clay loam; massive; friable, sticky and plastic; 75 percent rock fragments; strongly acid; clear wavy boundary.

R—66 inches; dusky red (10R 3/4) and light brownish gray (2.5Y 6/2) shale and sandstone bedrock.

The solum ranges from 40 to 75 inches in thickness. Depth to bedrock is more than 60 inches. Depth to the fragipan ranges from 25 to 40 inches. Rock fragments range from 5 to 30 percent, by volume, in the A and Bt horizons, from 10 to 50 percent in the Bx horizon, and from 25 to 80 percent in the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid throughout.

The Ap horizon has hue of 5YR or 7.5YR, value of 3 to 5, and chroma of 2 to 4.

The Bt horizon has hue of 5YR to 10R, value of 3 to 5, and chroma of 3 to 6. Fine earth texture ranges from silt loam to silty clay loam.

The Bx horizon has hue of 5YR to 10R, value of 3 to 5, and chroma of 4. Fine earth texture ranges from silt loam to silty clay loam.

The C horizon has hue of 10R to 2.5Y, value of 3 to 6, and chroma of 3 to 6. Fine earth texture ranges from loam to silty clay loam.

Palms Series

The soils of the Palms series are loamy, mixed, euic, mesic Terric Medisaprists. These soils are very deep and very poorly drained. They are in the basins along the major streams in the northeastern part of the county. They formed in organic matter mostly from herbaceous plants. Slope ranges from 0 to 2 percent.

Palms soils are adjacent on the landscape to very deep, poorly drained Atkins soils, very deep, moderately well drained Basher and Philo soils, and very deep, well drained Barbour and Pope soils.

Typical pedon of Palms muck, in Annin Township, 0.7 mile south of Turtlepoint, 1,200 feet west of Pennsylvania Route 155, 3,600 feet southeast of the intersection of the railroad tracks and Legislative Route 42018, 50 feet west of the railroad tracks, on the Allegheny River flood plain:

Oa1—0 to 10 inches; black (10YR 2/1) muck (sapric material); about 10 percent fibers, 5 percent rubbed; moderate medium granular structure; very friable; slightly acid; clear smooth boundary.

Oa2—10 to 23 inches; very dark brown (10YR 2/2) muck (sapric material); 10 percent fiber, 3 percent rubbed; weak coarse subangular blocky structure; very friable; slightly acid; clear smooth boundary.

Oa3—23 to 40 inches; dark brown (10YR 3/3) muck (sapric material); 20 percent fibers, less than 10 percent rubbed; massive; very friable; slightly acid; abrupt smooth boundary.

Cg—40 to 60 inches; dark gray (10YR 4/1) silty clay loam; massive; sticky and plastic; neutral.

The organic material ranges from 25 to 50 inches in thickness. Depth to bedrock is more than 60 inches. Woody fragments in the organic material range from 0 to 15 percent. Reaction is slightly acid or neutral throughout.

The Oa1 and Oa2 horizons have hue of 10YR, value of 2, and chroma of 1 or 2.

The Oa3 horizon is neutral or has hue of 10YR or 7.5YR; value is 2 or 3 and chroma is 0 to 3.

The 2Cg horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 or 2. Fine earth texture ranges from clay loam to silty clay loam.

Philo Series

The soils of the Philo series are coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts. These soils are very deep and moderately well drained. They are on flood plains. They formed in alluvium from yellow and brown, acid sandstone and shale. Slope ranges from 0 to 3 percent.

Philo soils are adjacent on the landscape to very deep, well drained Pope soils and very deep, poorly drained Atkins soils.

Typical pedon of Philo silt loam, in Keating Township, 1.4 miles south of East Smethport, 100 feet east of the bridge over Potato Creek, 50 feet west of the stream, 50 feet north of Township Route 377, in a cultivated field:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; friable,

nonsticky and nonplastic; moderately acid; abrupt smooth boundary.
Bw1—7 to 15 inches; yellowish brown (10YR 5/6) silt loam; moderate medium granular structure; friable, nonsticky and nonplastic; strongly acid; gradual wavy boundary.
Bw2—15 to 34 inches; brown (10YR 5/3) fine sandy loam; common fine distinct gray (10YR 5/1) and strong brown (7.5YR 5/8) mottles; weak very fine subangular blocky structure; friable, nonsticky and nonplastic; strongly acid; gradual wavy boundary.
Cg1—34 to 46 inches; gray (10YR 5/1) sandy loam; common medium distinct strong brown (7.5YR 5/6) mottles; massive; friable, nonsticky and nonplastic; strongly acid; clear wavy boundary.
Cg2—46 to 66 inches; gray (10YR 5/1) very gravelly loamy sand; massive; friable, nonsticky and nonplastic; 40 percent rock fragments; strongly acid.

The solum ranges from 24 to 40 inches in thickness. Depth to low chroma mottling ranges from 12 to 24 inches. Depth to the Cg2 horizon ranges from 40 to 60 inches. Depth to bedrock is more than 60 inches. Rock fragments range from 0 to 20 percent, by volume, above the Cg2 horizon and from 20 to 60 percent in the Cg2 horizon. In unlimed areas reaction ranges from strongly acid to moderately acid.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 to 6. Fine earth texture ranges from silt loam to sandy loam.

The C horizon is neutral or has hue of 10YR, value is 4 or 5, and chroma is 0 to 2. Fine earth texture ranges from silt loam to sandy loam above a depth of 40 inches and silt loam to sand below that depth.

Pope Series

The soils of the Pope series are coarse-loamy, mixed, mesic Fluventic Dystrochrepts. These soils are very deep and well drained. They are on flood plains. They formed in alluvium from yellow and brown acid shale and sandstone. Slope ranges from 0 to 3 percent.

Pope soils are adjacent on the landscape to very deep, well drained Philo soils and very deep, poorly drained Atkins soils.

Typical pedon of Pope loam, in Keating Township, on Potato Creek, 1 mile north of Smethport, 750 feet north of bridge on Township Route 366, 15 feet east of creek bank:

Ap—0 to 6 inches; brown (10YR 4/3) loam; weak fine granular structure; friable, nonsticky and nonplastic; strongly acid; abrupt smooth boundary.
Bw1—6 to 18 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; strongly acid; gradual wavy boundary.
Bw2—18 to 41 inches; yellowish brown (10YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable, nonsticky and nonplastic; very strongly acid; gradual wavy boundary.
C—41 to 65 inches; yellowish brown (10YR 5/4) sandy loam; massive; friable, nonsticky and nonplastic; very strongly acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 60 inches. Rock fragments range from 0 to 30 percent, by volume, above a depth of 40 inches and from 0 to 60 percent below that depth. In unlimed areas reaction is strongly acid or very strongly acid throughout.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. Fine earth texture is fine sandy loam or loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. Fine earth texture ranges from loamy sand to loam.

Rexford Series

The soils of the Rexford series are coarse-loamy, mixed, mesic Aeric Fragiaquepts. These soils are very deep and somewhat poorly drained and poorly drained. They are on terraces of major streams. They formed in alluvium. Slope ranges from 0 to 3 percent.

Rexford soils are adjacent on the landscape to very deep, well drained Chenango soils and very deep, moderately well drained and somewhat poorly drained Braceville soils.

Typical pedon of Rexford silt loam, 0 to 3 percent slopes, in Ceres Township, 0.9 mile west of Ceres, 4,000 feet west of the junction of Pennsylvania Route 44 and Legislative Route 42028, 1,700 feet north of Oswayo Creek, 20 feet west of lane, 250 feet south of the New York state line, in a cultivated field:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable, nonsticky and nonplastic; moderately acid; abrupt smooth boundary.
Bw1—9 to 11 inches; yellowish brown (10YR 5/6) silt loam; common fine distinct gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm, slightly sticky and slightly plastic; moderately acid; clear wavy boundary.
Bw2—11 to 18 inches; brown (7.5YR 5/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; firm, slightly sticky and slightly plastic; 5

percent gravel; moderately acid; clear wavy boundary.

Bx1—18 to 34 inches; brown (7.5YR 5/4) loam; many fine distinct gray (10YR 6/1) and strong brown (7.5YR 5/8) mottles; moderate coarse prismatic structure parting to moderate medium platy; firm and brittle, nonsticky and nonplastic; few faint films in pores; 5 percent gravel; moderately acid; gradual wavy boundary.

Bx2—34 to 39 inches; dark brown (7.5YR 4/4) gravelly loam; medium prominent gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium platy; firm and brittle, nonsticky and nonplastic; few faint films in pores; 15 percent gravel; moderately acid; clear wavy boundary.

2C1—39 to 47 inches; dark brown (7.5YR 4/4) gravelly sandy loam; massive; firm, nonsticky and nonplastic; 30 percent gravel; moderately acid; clear wavy boundary.

2C2—47 to 60 inches; dark brown (7.5YR 4/4) very gravelly loamy sand; 40 percent gravel; moderately acid.

The solum ranges from 24 to 50 inches in thickness. Depth to bedrock is more than 60 inches. Depth to the fragipan is 15 to 24 inches. Rock fragments range from 0 to 15 percent, by volume, in the Ap and Bw horizons and from 5 to 40 percent in the Bx and 2C horizons. In unlimed areas reaction is strongly acid or moderately acid throughout.

The Ap horizon has hue of 10YR, value of 4, and chroma of 1 or 2.

The Bw horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 1 to 6. Fine earth texture is silt loam or loam.

The Bx horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 1 to 4. Fine earth texture is sandy loam, loam, or silt loam.

The 2C horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 1 to 6. Fine earth texture ranges from silt loam to sand.

Udorthents

Udorthents are very deep and well drained to somewhat poorly drained. Permeability is slow to rapid. These soils are on uplands. Areas of these soils were formed by excavating and stripping overburden to expose beds of coal and clay. The areas disturbed in these ways were eventually reclaimed. Udorthents also consist of quarries and areas where material was removed and used for highway construction. Slope ranges from 0 to 80 percent.

Udorthents are adjacent on the landscape to all other soils in the survey area, but are most commonly on the landscape with deep, well drained Hartleton soils and deep and very deep, moderately well drained Cookport soils.

Udorthents differ greatly from area to area. Consequently, a typical pedon is not given.

The solum ranges from 0 to 20 inches in thickness. Depth to bedrock is more than 60 inches. Rock fragments make up 15 to 80 percent of the volume throughout. Reaction is strongly acid to extremely acid throughout.

Some pedons have an A horizon that has hue of 5YR to 2.5Y and value and chroma of 0 to 8. Fine earth texture ranges from sandy loam to silty clay loam.

The C horizon has hue of 7.5YR to 5Y and value and chroma of 0 to 8. Fine earth texture ranges from sandy loam to silty clay loam.

Wharton Series

The soils of the Wharton series are fine-loamy, mixed, mesic Aquic Hapludults. These soils are deep and very deep and moderately well drained. They are on uplands. They formed in residuum from shale. Slope is 3 to 8 percent.

Wharton soils are adjacent on the landscape to very deep and deep, moderately well drained Cookport soils and very deep, somewhat poorly drained Cavode soils.

Typical pedon of Wharton silt loam, 3 to 8 percent slopes, in Lafayette Township, 3 miles west of Ormsby, 1 mile east of McKean County Airport, 100 feet north of Pennsylvania Route 59, in a cultivated field:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable, nonsticky and nonplastic; 5 percent rock fragments; very strongly acid; abrupt smooth boundary.

Bt1—7 to 19 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable, sticky and plastic; common faint clay films; 5 percent rock fragments; very strongly acid; clear wavy boundary.

Bt2—19 to 27 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm, sticky and plastic; common faint clay films; gray (10YR 6/1) coatings on peds; 10 percent rock fragments; very strongly acid; gradual wavy boundary.

Bt3—27 to 43 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct gray (10YR 6/1) mottles; moderate coarse prismatic structure; firm, sticky and plastic; common faint clay films; gray (10YR 6/1) coatings on prisms; 12 percent rock fragments; extremely acid; clear wavy boundary.

C—43 to 53 inches; brown (10YR 5/3) extremely channery silt loam; massive; friable, slightly sticky and slightly plastic; 60 percent rock fragments; extremely acid; clear wavy boundary.

R—53 inches; shale bedrock.

The solum ranges from 40 to 54 inches in thickness. Depth to bedrock ranges from 40 to 72 inches. Rock fragments make up 0 to 15 percent of the A and B horizons and 50 to 80 percent of the C horizon. In unlimed areas reaction ranges from strongly acid to extremely acid throughout.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. Fine earth texture is silty clay loam or clay loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 4. Fine earth texture ranges from silt loam to clay.

Formation of the Soils

This section, the process of soil formation, is described and related to the soils in McKean County.

Factors of Soil Formation

The characteristics of a soil at any given site depend on the physical and mineralogical composition of the parent material, the climate under which the soil has formed, the plant and animal life on and in the soil, the relief or the lay of the land, and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life are the active forces that change parent material into a soil that has genetically related horizons. The effects of climate and plant and animal life are influenced by relief and by the nature of the parent material. Finally, time is needed to change the parent material into a soil profile. A long time usually is needed for the development of distinct horizons.

The factors of soil formation are closely interrelated in their effects on the soil. Thus, few generalizations can be made about the effects of any one factor unless conditions are specified for the other four. Many processes of soil development are unknown.

Parent Material

Parent material is the unconsolidated mass from which a soil forms. It is composed of differing amounts of sand, silt, and clay and has differing kinds and amounts of chemicals and minerals. All other soil-forming factors affect parent material, but parent material determines the chemical and mineralogical composition of the soil.

In McKean County most soils on uplands formed in material weathered from interbedded shale, siltstone, and sandstone. Cavode soils formed in residuum of clay shale, and Hartleton soils in that of gray shale and siltstone. The subsoil of Hazleton soils is channery sandy loam because the parent material is dominantly sandstone. The subsoil of such soils on flood plains as Pope, Philo, and Atkins soils reflects the stratified nature of alluvium.

Climate

Precipitation totaling about 43 inches annually, including the snow cover 1 to 3 months as well as temperature, humidity, and wind, have been important in the formation of soils in McKean County. Ample precipitation and a dense or clayey substratum result in a seasonal high water table in many soils. The seasonal high water table accounts for the grayish color of the wetter soils, such as Atkins and Brinkerton soils. Climate also has affected the soils through its influence on the type of vegetation that grows in the area.

Plant and Animal Life

Vegetation, micro-organisms, earthworms, and other forms of life affect soil formation. The kind and quantity of vegetation, which depend on the parent material and the climate, are significant.

The climate of McKean County favors the growth of hardwood trees, and many of the soils formed under forests. Leaves, twigs, roots, and entire plants accumulate on the surface of forest soils. Organic matter is added to the soil as plant remains decompose through the action of micro-organisms, earthworms, and other forms of life. The uprooting of trees also influences soil formation by mixing the soil and loosening the underlying material.

Human activities have also influenced the effects and the rate of soil formation. These activities alter the soils by drainage, changing the vegetation, and tilling and compacting the soils.

Relief

Relief affects both surface runoff and internal drainage. Surface runoff influences the degree of erosion, and in turn, affects soil depth. Internal drainage affects the weathering of soil material and bedrock. On the steeper slopes the root zone is commonly restricted because rapid runoff reduces weathering and internal drainage. Also, on the steeper slopes the material erodes almost as fast as it forms. For example, on very steep Hartleton soils at the top of slopes depth to bedrock is less than on soils downslope. Albrights and Brinkerton soils, further downslope, increase in depth because of the constant downslope movement of soil material.

Time

The effect of climate, relief, and living organisms on changing parent material into soil is governed by the time these factors have been active. The degree of horizon development generally indicates the age of a

soil. Younger than most other soils in the county are Pope, Philo, Barbour, Basher, and Atkins soils, on flood plains. Although organic matter has accumulated on the surface of these soils, the horizons below the surface are less distinct than those in most soils on uplands. The horizons in Hazleton soils, on uplands, show that some changes have taken place. But the weathering of Hazleton soils was slowed by the effects of topography and parent material. The soils in the survey area that have developed profiles and distinct horizons include Cookport, Cavode, and Brinkerton soils.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 2.4
Low	2.4 to 3.2
Moderate	3.2 to 5.2
High	more than 5.2

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Carrying capacity. The maximum stocking rate possible without inducing damage to vegetation or related resources. The rate may vary from year to year because of fluctuating forage production.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Commercial forest lands. Areas of forest land that have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage and planting system in which crop residue covers at least 30 percent of the soil surface after planting. Where soil erosion by wind is the main concern, the system leaves the equivalent of at least 1,000 pounds per acre of flat small-grain residue on the surface during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a

soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They

have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

No-tillage. A method of planting crops that involves no seedbed preparation other than opening the soil for the purpose of placing the seed at the intended depth; usually involves opening a small slit or punching a hole into the soil; usually no cultivation during crop production; chemical weed control is normally used.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon,

hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Much has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multipled by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of rock fragments in a soil. Generally it is indicative of an old weathered

surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period the the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifiying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1957-81 at Bradford, Pennsylvania]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	26.5	11.1	18.8	55	-17	7	3.03	1.71	4.20	7	18.8
February---	28.8	11.4	20.1	55	-17	6	2.87	1.73	3.88	8	19.3
March------	38.9	21.4	30.2	70	-6	36	3.11	1.95	4.14	8	12.8
April------	52.8	31.9	42.4	80	10	119	3.34	2.18	4.39	8	3.5
May--------	64.3	40.7	52.5	85	22	396	3.52	2.10	4.79	9	.4
June-------	72.4	49.2	60.8	86	30	624	4.47	2.51	6.19	8	.0
July-------	75.9	53.4	64.7	88	35	766	4.40	2.91	5.75	8	.0
August-----	74.7	52.6	63.7	87	33	735	3.72	2.04	5.19	7	.0
September--	67.9	46.2	57.1	84	26	513	3.83	2.27	5.22	8	.0
October----	56.2	36.4	46.3	77	16	228	3.24	1.78	4.53	8	1.1
November---	43.1	28.3	35.7	67	5	56	3.50	2.26	4.62	10	8.3
December---	31.1	17.5	24.3	58	-11	13	3.48	2.25	4.58	9	20.2
Yearly:											
Average--	52.7	33.3	43.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	90	-19	---	---	---	---	---	---
Total----	---	---	---	---	---	3,499	42.51	37.21	47.94	98	84.4

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1957-81 at Bradford, Pennsylvania]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 18	June 1	June 15
2 years in 10 later than--	May 12	May 27	June 10
5 years in 10 later than--	May 1	May 18	May 31
First freezing temperature in fall:			
1 year in 10 earlier than--	September 28	September 17	August 27
2 years in 10 earlier than--	October 5	September 23	September 4
5 years in 10 earlier than--	October 16	October 5	September 19

TABLE 3.--GROWING SEASON

[Recorded in the period 1957-81 at Bradford, Pennsylvania]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	141	114	80
8 years in 10	150	123	90
5 years in 10	167	140	109
2 years in 10	185	156	139
1 year in 10	194	165	139

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AbB	Albrights silt loam, 3 to 8 percent slopes	8,450	1.3
AbC	Albrights silt loam, 8 to 15 percent slopes	22,440	3.5
AdC	Albrights silt loam, 8 to 15 percent slopes, very stony	1,225	0.2
At	Atkins silt loam	8,920	1.4
Ba	Barbour loam	1,415	0.2
Bb	Basher silt loam	4,495	0.7
BeB	Braceville silt loam, 3 to 8 percent slopes	1,560	0.2
BrA	Brinkerton silt loam, 0 to 3 percent slopes	4,370	0.7
BrB	Brinkerton silt loam, 3 to 8 percent slopes	3,430	0.5
BsB	Brinkerton silt loam, 0 to 8 percent slopes, very stony	5,250	0.8
BuB	Buchanan silt loam, 3 to 8 percent slopes	11,310	1.8
BuC	Buchanan silt loam, 8 to 15 percent slopes	14,160	2.2
BxB	Buchanan silt loam, 0 to 8 percent slopes, very stony	16,190	2.5
BxD	Buchanan silt loam, 8 to 25 percent slopes, very stony	55,550	8.7
CaA	Cavode silt loam, 0 to 3 percent slopes	975	0.2
CaB	Cavode silt loam, 3 to 8 percent slopes	3,230	0.5
ChB	Chenango gravelly loam, 3 to 8 percent slopes	1,070	0.2
ClB	Clymer loam, 3 to 8 percent slopes	3,580	0.6
CoA	Cookport loam, 0 to 3 percent slopes	10,500	1.6
CoB	Cookport loam, 3 to 8 percent slopes	59,225	9.3
CoC	Cookport loam, 8 to 15 percent slopes	5,765	0.9
CpB	Cookport loam, 0 to 8 percent slopes, very stony	34,685	5.4
CpD	Cookport loam, 8 to 25 percent slopes, very stony	16,615	2.6
HaB	Hartleton channery silt loam, 3 to 8 percent slopes	5,990	0.9
HaC	Hartleton channery silt loam, 8 to 15 percent slopes	9,825	1.5
HaD	Hartleton channery silt loam, 15 to 25 percent slopes	10,380	1.6
HbB	Hazleton channery loam, 3 to 8 percent slopes	20,165	3.2
HbC	Hazleton channery loam, 8 to 15 percent slopes	9,625	1.5
HdB	Hazleton channery loam, 0 to 8 percent slopes, very stony	26,635	4.2
HdD	Hazleton channery loam, 8 to 25 percent slopes, very stony	28,025	4.4
HeF	Hartleton and Buchanan soils, 25 to 60 percent slopes	152,540	24.1
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes	1,065	0.2
LeC	Leck Kill channery silt loam, 8 to 15 percent slopes	5,825	0.9
LeD	Leck Kill channery silt loam, 15 to 25 percent slopes	17,330	2.7
LeF	Leck Kill channery silt loam, 25 to 50 percent slopes	33,055	5.2
MeD	Meckesville channery silt loam, 15 to 25 percent slopes	1,365	0.2
Pa	Palms muck	245	*
Ph	Philo silt loam	10,620	1.7
Po	Pope loam	2,015	0.3
ReA	Rexford silt loam, 0 to 3 percent slopes	385	0.1
Sm	Udorthents, extremely channery	1,245	0.2
WaB	Wharton silt loam, 3 to 8 percent slopes	4,135	0.6
W	Water	3,200	0.5
	Total	638,080	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
AbB	Albrights silt loam, 3 to 8 percent slopes
Ba	Barbour loam
Bb	Basher silt loam
BeB	Braceville silt loam, 3 to 8 percent slopes
BuB	Buchanan silt loam, 3 to 8 percent slopes
ChB	Chenango gravelly loam, 3 to 8 percent slopes
ClB	Clymer loam, 3 to 8 percent slopes
CoA	Cookport loam, 0 to 3 percent slopes
CoB	Cookport loam, 3 to 8 percent slopes
HbB	Hazleton channery loam, 3 to 8 percent slopes
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes
Ph	Philo silt loam
Po	Pope loam
WaB	Wharton silt loam, 3 to 8 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Tons	Bu	Bu	Tons	Tons	AUM*
AbB---- Albrights	IIe	100	20	70	40	3.5	3.0	5.8
AbC---- Albrights	IIIe	90	18	65	40	3.5	3.0	5.8
AdC---- Albrights	VIs	---	---	---	---	---	---	---
At---- Atkins	IIIw	100	20	60	30	---	3.0	5.8
Ba---- Barbour	I	120	24	80	---	4.5	3.5	6.6
Bb---- Basher	IIw	120	---	80	---	4.5	3.5	6.6
BeB---- Braceville	IIw	105	21	80	---	4.5	3.5	6.6
BrA---- Brinkerton	IVw	90	18	60	---	---	2.5	4.8
BrB---- Brinkerton	IVw	90	18	60	---	---	2.5	4.8
BsB. Brinkerton	VIs	---	---	---	---	---	---	---
BuB---- Buchanan	IIe	100	---	65	40	3.5	3.0	5.8
BuC---- Buchanan	IIIe	90	---	60	35	3.5	3.0	5.8
BxB---- Buchanan	VIs	---	---	---	---	---	---	---
BxD---- Buchanan	VIs	---	---	---	---	---	---	---
CaA---- Cavode	IIIw	85	17	65	35	---	3.0	5.8
CaB---- Cavode	IIIw	85	17	65	35	---	3.0	5.8
ChB---- Chenango	IIs	100	---	80	---	4.5	3.5	6.6
ClB---- Clymer	IIe	120	24	75	45	4.5	3.5	6.6
CoA---- Cookport	IIw	100	20	65	40	3.5	3.0	5.8

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Tons	Bu	Bu	Tons	Tons	AUM*
CoB---- Cookport	IIe	100	20	65	40	3.5	3.0	5.8
CoC---- Cookport	IIIe	90	18	60	35	3.5	3.0	5.8
CpB---- Cookport	VIs	---	---	---	---	---	---	---
CpD---- Cookport	VIs	---	---	---	---	---	---	---
HaB---- Hartleton	IIe	80	16	65	35	3.5	3.0	5.8
HaC---- Hartleton	IIIe	75	15	60	35	3.0	2.5	4.8
HaD---- Hartleton	IVe	70	14	55	30	3.0	2.0	3.8
HbB---- Hazleton	IIe	125	25	75	45	4.5	3.5	6.6
HbC---- Hazleton	IIIe	115	23	70	40	4.5	3.5	6.6
HdB---- Hazleton	VIs	---	---	---	---	---	---	---
HdD---- Hazleton	VIs	---	---	---	---	---	---	---
HeF---- Hartleton and Buchanan	VIIe	---	---	---	---	---	---	---
LeB---- Leck Kill	IIe	125	25	---	50	4.5	3.0	5.8
LeC---- Leck Kill	IIIe	120	24	---	50	4.0	3.0	5.8
LeD---- Leck Kill	IVe	105	21	---	45	4.0	2.5	4.8
LeF---- Leck Kill	VIIe	---	---	---	---	---	---	---
MeD---- Meckesville	IVe	85	17	60	30	---	3.5	6.6
Pa. Palms								
Ph---- Philo	IIw	130	---	80	45	4.5	3.5	6.6
Po---- Pope	I	130	---	80	45	---	4.0	7.6

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Corn silage	Oats	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Tons	Bu	Bu	Tons	Tons	AUM*
ReA---------- Rexford Sm. Udorthents	IIIw	80	---	65	35	3.0	---	5.8
WaB---------- Wharton	IIe	90	18	65	40	3.5	3.0	5.8

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	3,430	---	---	---
II	142,165	113,920	27,175	1,070
III	81,150	67,640	13,510	---
IV	37,120	29,075	8,045	---
V	---	---	---	---
VI	184,175	---	---	184,175
VII	185,595	185,595	---	---
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
AbB---------- Albrights	4A	Slight	Slight	Slight	Slight	Northern red oak----	70	4	Eastern white pine, white spruce, Norway spruce, Japanese larch, black cherry.
						Black cherry--------	---	--	
						White ash----------	---	--	
						Red maple----------	---	--	
						Sugar maple---------	---	--	
						Eastern hemlock-----	---	--	
AbC, AdC-------- Albrights	4A	Slight	Slight	Slight	Slight	Northern red oak----	70	4	Eastern white pine, white spruce, Norway spruce, Japanese larch, black cherry.
						Black cherry--------	---	--	
						White ash----------	---	--	
						Red maple----------	---	--	
						Black cherry--------	---	--	
						Sugar maple---------	---	--	
At---------- Atkins	4W	Slight	Severe	Severe	Moderate	Red maple----------	60	3	Eastern white pine, white spruce, American sycamore.
						American sycamore---	---	--	
						American elm--------	---	--	
Ba---------- Barbour	3A	Slight	Slight	Slight	Slight	Sugar maple---------	70	3	Eastern white pine, Norway spruce, red pine, Japanese larch, black cherry, black walnut.
						Northern red oak----	80	4	
						Black cherry--------	---	--	
						White ash----------	---	--	
Bb---------- Basher	3A	Slight	Slight	Slight	Slight	Sugar maple---------	70	3	Eastern white pine, red pine, Norway spruce, Japanese larch, black cherry, black walnut.
						Northern red oak----	80	4	
						Black cherry--------	---	--	
						White ash----------	---	--	
BeB---------- Braceville	4A	Slight	Slight	Slight	Slight	Northern red oak----	80	4	Japanese larch, Norway spruce, eastern white pine, black cherry.
						White ash----------	---	--	
						Sugar maple---------	---	--	
						Black cherry--------	---	--	
						Red maple----------	---	--	
BrA, BrB, BsB--- Brinkerton	4W	Slight	Severe	Severe	Moderate	Northern red oak----	77	4	Eastern white pine, white spruce, red maple, Norway spruce.
						Red maple----------	---	--	
						Eastern hemlock-----	---	--	
						White ash----------	---	--	
						Yellow birch--------	---	--	
BuB, BuC-------- Buchanan	4A	Slight	Slight	Slight	Slight	Northern red oak----	70	4	Eastern white pine, Japanese larch, Norway spruce, Northern red oak, yellow-poplar, sugar maple.
						Sugar maple---------	---	--	
						Black cherry--------	80	4	
						Red maple----------	---		
						American Beech------	---		

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
BxB---------- Buchanan	4A	Slight	Slight	Slight	Slight	Northern red oak----	70	4	Eastern white pine, Japanese larch, Norway spruce, northern red oak, yellow-poplar, sugar maple.
						Sugar maple---------	---	--	
						Black cherry--------	80	--	
						Red maple-----------	---	--	
						American Beech------	---	--	
BxD---------- Buchanan	3X	Moderate	Moderate	Slight	Slight	Northern red oak----	70	4	Eastern white pine, Japanese larch, Norway spruce, northern red oak, yellow-poplar, sugar maple.
						Sugar maple---------	---	--	
						Black cherry--------	80	4	
						Red maple-----------	---	--	
						American beech------	---	--	
CaA, CaB-------- Cavode	4W	Slight	Moderate	Moderate	Moderate	Northern red oak----	82	4	Eastern white pine, Norway spruce, white spruce, black cherry.
						Black cherry--------	---	--	
						Red maple-----------	---	--	
						Eastern hemlock-----	---	--	
						Yellow birch--------	---	--	
ChB---------- Chenango	3A	Slight	Slight	Slight	Slight	Sugar maple---------	70	3	Eastern white pine, red pine, Japanese larch, black cherry.
						Northern red oak----	80	4	
						Black cherry--------	89	5	
						Red maple-----------	---	--	
						White ash-----------	---	--	
						Yellow-poplar-------	90	6	
ClB---------- Clymer	4A	Slight	Slight	Slight	Slight	Northern red oak----	70	4	Eastern white pine, red pine, Norway spruce, Japanese larch, black cherry.
						Black cherry--------	75	3	
						Sugar maple---------	70	3	
CoA, CoB, CoC--- Cookport	4W	Slight	Moderate	Slight	Slight	Northern red oak----	78	4	Eastern white pine, red pine, Japanese larch, Norway spruce, white spruce, black cherry.
						Black cherry--------	82	5	
						White ash-----------	75	3	
						Sugar maple---------	67	3	
						Red maple-----------	---	--	
						American Beech------	---	--	
CpB---------- Cookport	4W	Slight	Moderate	Slight	Slight	Northern red oak----	78	4	Eastern white pine, red pine, Japanese larch, white spruce, black cherry, Norway spruce.
						Black cherry--------	82	5	
						White ash-----------	75	3	
						Sugar maple---------	82	3	
						Red maple-----------	---	--	
						American Beech------	---	--	
CpD---------- Cookport	4W	Moderate	Moderate	Slight	Slight	Northern red oak----	78	4	Eastern white pine, red pine, Japanese larch, Norway spruce, white spruce, black cherry.
						Black cherry--------	82	5	
						White ash-----------	75	3	
						Sugar maple---------	67	3	
						Red maple-----------	---	--	
						American Beech------	---	--	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
HaB, HaC-------- Hartleton	4F	Slight	Slight	Slight	Slight	Northern red oak---- Black cherry-------- White ash---------- Sugar maple--------- Red maple---------- American beech------	70 --- --- --- --- ---	4 -- -- -- -- --	Red pine, eastern white pine, Japanese larch, Norway spruce, white spruce, black cherry.
HaD------------- Hartleton	4R	Slight	Moderate	Slight	Slight	Northern red oak---- Black cherry-------- White ash---------- Yellow-poplar------- Sugar maple--------- Red pine---------- American beech------	70 --- --- --- --- --- ---	4 -- -- -- -- -- --	Red pine, eastern white pine, Japanese larch, Norway spruce, white spruce, black cherry.
HbB, HbC, HdB--- Hazleton	4F	Slight	Slight	Slight	Slight	Northern red oak---- Black cherry-------- White ash---------- Sugar maple--------- Red maple---------- American beech------	70 80 75 --- --- ---	4 4 3	Red pine, eastern white pine, Norway spruce, Japanese larch, black cherry.
HdD------------- Hazleton	4R	Slight	Moderate	Slight	Slight	Northern red oak---- Black cherry-------- White ash---------- Sugar maple--------- Red maple---------- American beech------	70 80 75 --- --- ---	4 4 3 -- -- --	Red pine, eastern white pine, Japanese larch, Norway spruce, black cherry.
HeF**----------- Hartleton	4R	Severe	Severe	Slight	Slight	Northern red oak---- Black cherry-------- White ash---------- Sugar maple--------- Red maple---------- American beech------	70 80 75 --- --- ---	4 4 3 -- -- --	Red pine, eastern white pine, Japanese larch, Norway spruce, black cherry.
Buchanan---------	4R	Severe	Severe	Slight	Slight	Northern red oak---- Sugar maple--------- Black cherry-------- Red maple---------- American Beech------	70 --- 80 --- ---	4 -- 4	Eastern white pine, Japanese larch, Norway spruce, Northern red oak, yellow-poplar, sugar maple.
LeB, LeC-------- Leck Kill	4A	Slight	Slight	Slight	Slight	Northern red oak---- Sugar maple--------- Red maple---------- White ash----------	74 75 --- 75	4 3 -- 3	Eastern white pine, red pine, Japanese larch, Norway spruce.
LeD------------- Leck Kill	4R	Slight	Moderate	Slight	Slight	Northern red oak---- Sugar maple--------- Red maple---------- White ash----------	74 75 --- 75	4 3 -- 3	Eastern white pine, red pine, Japanese larch, Norway spruce.
LeF**----------- Leck Kill	4R	Moderate	Severe	Slight	Slight	Northern red oak---- Sugar maple--------- Red maple---------- White ash----------	74 75 --- 75	4 3 -- 3	Eastern white pine, red pine, Japanese larch, Norway spruce.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Productivity class*	
MeD---------- Meckesville	4R	Slight	Moderate	Slight	Slight	Northern red oak----	70	4	Eastern white pine, Japanese larch, red pine, Norway spruce, black cherry, white spruce.
						Sugar maple---------	---	--	
						Black cherry--------	---	--	
						White ash-----------	---	--	
Pa---------- Palms	2W	Slight	Severe	Severe	Severe	Red maple-----------	55	2	White spruce, American sycamore.
						White ash-----------	---	--	
						American sycamore---	---	--	
Ph---------- Philo	5W	Slight	Moderate	Slight	Slight	Northern red oak----	85	5	Eastern white pine, Norway spruce, white spruce, American sycamore, red maple.
						White ash-----------	---	--	
						American sycamore---	---	--	
						American elm--------	---	--	
						Red maple-----------	---	--	
								--	
Po---------- Pope	5A	Slight	Slight	Slight	Slight	Northern red oak----	85	5	Eastern white pine, American sycamore, red maple, black walnut.
						Eastern white pine--	---	--	
						American sycamore---	---	--	
						Red maple-----------	---	--	
						American elm--------	---	--	
ReA---------- Rexford	4W	Slight	Moderate	Moderate	Moderate	Northern red oak----	70	4	Norway spruce, white spruce, eastern white pine, American sycamore, red maple, black cherry.
						White ash-----------	---	--	
						Sugar maple---------	---	--	
						Black cherry--------	---	--	
						American sycamore---	---	--	
						Red maple-----------	---	--	
						American beech------	---	--	
WaB---------- Wharton	4A	Slight	Slight	Slight	Slight	Northern red oak----	76	4	Eastern white pine, Norway spruce, black cherry, Japanese larch.
						Black cherry--------	73	3	
						White ash-----------	71	3	
						Sugar maple---------	69	3	
						Red maple-----------	---	--	
						American beech	---	--	

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AbB---------- Albrights	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
AbC---------- Albrights	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
AdC---------- Albrights	Severe: wetness.	Severe: wetness.	Severe: large stones, slope, small stones.	Severe: wetness.	Severe: wetness.
At---------- Atkins	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Ba---------- Barbour	Severe: flooding.	Slight----------	Moderate: small stones.	Slight----------	Moderate: flooding, droughty.
Bb---------- Basher	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: wetness, flooding.
BeB---------- Braceville	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Severe: wetness.
BrA, BrB---------- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
BsB---------- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness, large stones.	Severe: wetness.	Severe: wetness.
BuB---------- Buchanan	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
BuC---------- Buchanan	Severe: wetness.	Severe: wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
BxB---------- Buchanan	Severe: wetness.	Severe: wetness.	Severe: large stones, small stones.	Severe: wetness.	Severe: small stones, wetness.
BxD---------- Buchanan	Severe: slope, wetness.	Severe: slope, wetness.	Severe: large stones, slope, small stones.	Severe: wetness.	Severe: small stones, wetness, slope.
CaA, CaB---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
ChB---------- Chenango	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Moderate: small stones, droughty.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
ClB---------- Clymer	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
CoA---------- Cookport	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: small stones.	Severe: erodes easily.	Moderate: wetness.
CoB---------- Cookport	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: slope, small stones.	Severe: erodes easily.	Moderate: wetness.
CoC---------- Cookport	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness.	Severe: slope.	Severe: erodes easily.	Moderate: slope, wetness.
CpB---------- Cookport	Moderate: wetness, large stones.	Moderate: large stones, wetness.	Severe: large stones.	Slight----------	Moderate: large stones, wetness.
CpD---------- Cookport	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Moderate: slope.	Severe: slope.
HaB---------- Hartleton	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Severe: large stones.
HaC---------- Hartleton	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight----------	Severe: large stones.
HaD---------- Hartleton	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: large stones, slope.
HbB---------- Hazleton	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Moderate: small stones, droughty.
HbC---------- Hazleton	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: small stones, slope.	Slight----------	Moderate: slope, small stones.
HdB---------- Hazleton	Moderate: large stones.	Moderate: large stones.	Severe: small stones, large stones.	Slight----------	Moderate: large stones.
HdD---------- Hazleton	Severe: slope.	Severe: slope.	Severe: slope, small stones, large stones.	Moderate: slope.	Severe: slope.
HeF*: Hartleton----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: large stones, slope.
Buchanan----------	Severe: slope, wetness.	Severe: slope, wetness.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness, slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
LeB---------- Leck Kill	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Moderate: small stones.
LeC---------- Leck Kill	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight----------	Moderate: small stones, slope.
LeD---------- Leck Kill	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
LeF*---------- Leck Kill	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
MeD---------- Meckesville	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
Pa---------- Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
Ph---------- Philo	Severe: flooding.	Moderate: wetness.	Moderate: flooding, wetness.	Slight----------	Moderate: flooding.
Po---------- Pope	Severe: flooding.	Slight----------	Moderate: small stones, flooding.	Severe: erodes easily.	Moderate: flooding.
ReA---------- Rexford	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
SM*. Udorthents					
WaB---------- Wharton	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, percs slowly, wetness.	Slight----------	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AbB---- Albrights	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AbC---- Albrights	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AdC---- Albrights	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
At---- Atkins	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
Ba---- Barbour	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Bb---- Basher	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
BeB---- Braceville	Good	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
BrA---- Brinkerton	Poor	Fair	Good	Fair	Fair	Good	Good	Fair	Fair	Good.
BrB---- Brinkerton	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
BsB. Brinkerton										
BuB---- Buchanan	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
BuC---- Buchanan	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
BxB---- Buchanan	Very poor.	Poor	Good	Good	Good	Fair	Very poor.	Poor	Good	Poor.
BxD---- Buchanan	Very poor.	Poor	Good	Good	---	Poor	Very poor.	Poor	Good	Very poor.
CaA---- Cavode	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
CaB---- Cavode	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ChB---- Chenango	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
ClB---- Clymer	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CoA---- Cookport	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
CoB---- Cookport	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CoC---- Cookport	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CpB---- Cookport	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
CpD---- Cookport	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
HaB---- Hartleton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HaC---- Hartleton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HaD---- Hartleton	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
HbB---- Hazleton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HbC---- Hazleton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
HdB---- Hazleton	Very poor.	Poor	Good	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
HdD---- Hazleton	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
HeF*: Hartleton. Buchanan.										
LeB---- Leck Kill	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LeC---- Leck Kill	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
LeD---- Leck Kill	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
LeF*---- Leck Kill	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
MeD---- Meckesville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Pa---- Palms	Good	Poor	Poor	Poor	Poor	Good	Good	Fair	Poor	Good.
Ph---- Philo	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Po---------- Pope	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ReA---------- Rexford	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
SM*. Udorthents										
WaB---------- Wharton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AbB---------- Albrights	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
AbC, AdC---------- Albrights	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Severe: wetness.	Severe: wetness.
At---------- Atkins	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, frost action.	Severe: wetness, flooding.
Ba---------- Barbour	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, droughty.
Bb---------- Basher	Severe: wetness, cutbanks cave.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: wetness, flooding.
BeB---------- Braceville	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
BrA, BrB, BsB----- Brinkerton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action, low strength.	Severe: wetness.
BuB---------- Buchanan	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
BuC---------- Buchanan	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, slope.	Severe: wetness.	Severe: wetness.
BxB---------- Buchanan	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: small stones, wetness.
BxD---------- Buchanan	Severe: wetness, slope.	Severe: wetness, slope.	Severe: wetness, slope.	Severe: wetness, slope.	Severe: wetness, slope.	Severe: small stones, wetness, slope.
CaA, CaB---------- Cavode	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength, wetness.	Severe: wetness.
ChB---------- Chenango	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: small stones, droughty.
ClB---------- Clymer	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Slight.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
CoA---------- Cookport	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, low strength.	Moderate: wetness.
CoB---------- Cookport	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: wetness, low strength.	Moderate: wetness.
CoC---------- Cookport	Severe: wetness.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Moderate: slope, wetness, low strength.	Moderate: slope, wetness.
CpB---------- Cookport	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Moderate: wetness, low strength.	Moderate: large stones, wetness.
CpD---------- Cookport	Severe: slope, wetness.	Severe: slope.	Severe: slope, wetness.	Severe: slope.	Severe: slope.	Severe: slope.
HaB---------- Hartleton	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
HaC---------- Hartleton	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: slope, large stones.	Severe: large stones.	Severe: large stones.
HaD---------- Hartleton	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.
HbB---------- Hazleton	Moderate: depth to rock, large stones.	Moderate: large stones.	Moderate: large stones, depth to rock.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Moderate: small stones, droughty.
HbC---------- Hazleton	Moderate: depth to rock, slope, large stones.	Moderate: slope, large stones.	Moderate: slope, large stones, depth to rock.	Severe: slope.	Moderate: slope, frost action, large stones.	Moderate: slope, small stones.
HdB---------- Hazleton	Moderate: depth to rock, large stones.	Moderate: large stones.	Moderate: large stones, depth to rock.	Moderate: slope, large stones.	Moderate: frost action, large stones.	Moderate: large stones.
HdD---------- Hazleton	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HeF*: Hartleton--------	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: large stones, slope.
Buchanan---------	Severe: wetness, slope.	Severe: wetness, slope.	Severe: wetness, slope.	Severe: wetness, slope.	Severe: wetness, slope.	Severe: wetness, slope.
LeB---------- Leck Kill	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: small stones.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
LeC---------- Leck Kill	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: small stones, slope.
LeD, LeF*--------- Leck Kill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MeD---------- Meckesville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Pa---------- Palms	Severe: excess humus, ponding.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, low strength.	Severe: ponding, frost action, subsides.	Severe: ponding, excess humus.
Ph---------- Philo	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Po---------- Pope	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
ReA---------- Rexford	Severe: wetness, cutbanks cave.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.	Severe: wetness.
Sm*. Udorthents						
WaB---------- Wharton	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: slope, wetness, shrink-swell.	Severe: frost action, low strength.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AbB---- Albrights	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
AbC, AdC---- Albrights	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
At---- Atkins	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Poor: wetness.
Ba---- Barbour	Severe: flooding, wetness, poor filter.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, small stones.
Bb---- Basher	Severe: flooding, wetness.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness.	Poor: seepage, too sandy, small stones.
BeB---- Braceville	Severe: percs slowly, wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: wetness, seepage.	Poor: seepage, too sandy, small stones.
BrA---- Brinkerton	Severe: wetness, percs slowly.	Slight----	Severe: wetness.	Severe: wetness.	Poor: wetness.
BrB, BsB---- Brinkerton	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.
BuB---- Buchanan	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
BuC---- Buchanan	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
BxB---- Buchanan	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: small stones, wetness.
BxD---- Buchanan	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: wetness, slope.	Severe: wetness, slope.	Poor: small stones, slope, wetness.
CaA---- Cavode	Severe: percs slowly, wetness.	Moderate: depth to rock.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CaB---------- Cavode	Severe: percs slowly, wetness.	Moderate: slope, depth to rock.	Severe: wetness, depth to rock, too clayey.	Severe: wetness.	Poor: too clayey, wetness.
ChB---------- Chenango	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ClB---------- Clymer	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: small stones.
CoA, CoB---------- Cookport	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, depth to rock.	Moderate: wetness, depth to rock.	Fair: area reclaim, too clayey, wetness.
CoC---------- Cookport	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, depth to rock.	Moderate: slope, wetness, depth to rock.	Fair: area reclaim, wetness, slope.
CpB---------- Cookport	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, depth to rock.	Moderate: wetness, depth to rock.	Fair: area reclaim, too clayey, wetness.
CpD---------- Cookport	Severe: slope, wetness, percs slowly.	Severe: slope, wetness.	Severe: slope, wetness, depth to rock.	Severe: slope.	Poor: slope.
HaB---------- Hartleton	Severe: large stones.	Severe: seepage, large stones.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: large stones.
HaC---------- Hartleton	Severe: large stones.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: large stones.
HaD---------- Hartleton	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: large stones, slope.
HbB---------- Hazleton	Severe: poor filter.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
HbC---------- Hazleton	Severe: poor filter.	Severe: slope, seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
HdB---------- Hazleton	Severe: poor filter.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HdD---------- Hazleton	Severe: poor filter, slope.	Severe: slope, seepage.	Severe: slope, seepage, depth to rock.	Severe: slope, seepage.	Poor: slope, small stones.
HeF*: Hartleton----------	Severe: slope, large stones.	Severe: seepage, slope, large stones.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: large stones, slope.
Buchanan----------	Severe: wetness, percs slowly, slope.	Severe: slope, wetness.	Severe: wetness, slope.	Severe: wetness, slope.	Poor: small stones, slope, wetness.
LeB---------- Leck Kill	Moderate: percs slowly, depth to rock.	Severe: seepage.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
LeC---------- Leck Kill	Moderate: percs slowly, slope, depth to rock.	Severe: seepage, slope.	Severe: seepage, depth to rock.	Severe: seepage.	Poor: small stones.
LeD, LeF*---------- Leck Kill	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, depth to rock.	Severe: seepage, slope.	Poor: small stones, slope.
MeD---------- Meckesville	Severe: wetness, percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope, thin layer.
Pa---------- Palms	Severe: subsides, ponding.	Severe: seepage, excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, seepage.	Poor: ponding, excess humus.
Ph---------- Philo	Severe: flooding, wetness, poor filter.	Severe: flooding, wetness, seepage.	Severe: flooding, depth to rock, seepage.	Severe: flooding, wetness.	Fair: area reclaim, wetness, thin layer.
Po---------- Pope	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
ReA---------- Rexford	Severe: percs slowly, wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
Sm*. Udorthents					
WaB---------- Wharton	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AbB, AbC, AdC--------- Albrights	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, wetness.
At---------- Atkins	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ba---------- Barbour	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
Bb---------- Basher	Fair: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim.
BeB---------- Braceville	Poor: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim, wetness.
BrA, BrB, BsB--------- Brinkerton	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
BuB, BuC, BxB--------- Buchanan	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, wetness.
BxD---------- Buchanan	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones, area reclaim.
CaA, CaB---------- Cavode	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
ChB---------- Chenango	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
ClB---------- Clymer	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
CoA, CoB, CoC--------- Cookport	Fair: low strength, wetness, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
CpB---------- Cookport	Fair: area reclaim, wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CpD---------- Cookport	Fair: area reclaim, wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
HaB, HaC---------- Hartleton	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim.
HaD---------- Hartleton	Poor: large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
HbB, HbC, HdB--------- Hazleton	Fair: area reclaim, thin layer, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
HdD---------- Hazleton	Fair: slope, area reclaim, large stones.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
HeF*: Hartleton----------	Poor: large stones, slope.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: large stones, area reclaim, slope.
Buchanan----------	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones, area reclaim.
LeB, LeC---------- Leck Kill	Fair: thin layer, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
LeD---------- Leck Kill	Fair: thin layer, slope, area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
LeF*---------- Leck Kill	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
MeD---------- Meckesville	Fair: wetness, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Pa---------- Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, excess humus.
Ph---------- Philo	Fair: area reclaim, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Po Pope	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
ReA Rexford	Poor: wetness, thin layer.	Probable	Probable	Poor: wetness, small stones, area reclaim.
Sm*. Udorthents				
WaB Wharton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
AbB---- Albrights	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Slope----	Wetness, rooting depth.	Wetness, droughty, rooting depth.
AbC---- Albrights	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Slope----	Slope, wetness, rooting depth.	Wetness, slope, droughty.
AdC---- Albrights	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Slope----	Slope, rooting depth, wetness.	Wetness, slope, erodes easily.
At---- Atkins	Severe: seepage.	Severe: piping, wetness.	Severe: slow refill.	Flooding, frost action, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Ba---- Barbour	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Deep to water	Too sandy----	Droughty.
Bb---- Basher	Moderate: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave, slow refill.	Flooding, frost action, cutbanks cave.	Wetness, too sandy.	Favorable.
BeB---- Braceville	Severe: seepage.	Severe: seepage, wetness.	Severe: no water.	Slope, percs slowly.	Wetness, rooting depth, percs slowly.	Percs slowly, wetness, droughty.
BrA---- Brinkerton	Slight----	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Percs slowly, wetness, rooting depth.	Percs slowly, wetness, rooting depth.
BrB---- Brinkerton	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Percs slowly, wetness, rooting depth.	Percs slowly, wetness, rooting depth.
BsB---- Brinkerton	Moderate: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Percs slowly, wetness, large stones.	Wetness, large stones, rooting depth.
BuB---- Buchanan	Moderate: seepage, slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, slope.	Large stones, wetness.	Large stones, wetness.
BuC---- Buchanan	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, slope.	Slope, large stones, wetness.	Large stones, wetness, slope.
BxB---- Buchanan	Moderate: seepage, slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, slope.	Large stones, wetness.	Large stones, wetness.
BxD---- Buchanan	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, slope.	Slope, large stones, wetness.	Large stones, wetness, slope.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
CaA---------- Cavode	Moderate: depth to rock.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
CaB---------- Cavode	Moderate: depth to rock, slope.	Severe: piping, wetness.	Severe: no water.	Slope, percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.
ChB---------- Chenango	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Too sandy------	Droughty.
ClB---------- Clymer	Moderate: seepage, depth to rock, slope.	Severe: piping.	Severe: no water.	Deep to water	Large stones---	Large stones.
CoA---------- Cookport	Moderate: depth to rock.	Severe: piping.	Severe: no water.	Percs slowly---	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth.
CoB---------- Cookport	Moderate: depth to rock, slope.	Severe: piping.	Severe: no water.	Slope, percs slowly.	Erodes easily, wetness, rooting depth.	Erodes easily, rooting depth.
CoC---------- Cookport	Severe: slope.	Severe: piping.	Severe: no water.	Slope, percs slowly.	Slope, erodes easily, wetness.	Slope, erodes easily.
CpB---------- Cookport	Moderate: depth to rock, slope.	Severe: piping.	Severe: no water.	Slope, percs slowly.	Wetness, percs slowly, rooting depth.	Rooting depth, percs slowly.
CpD---------- Cookport	Severe: slope.	Severe: piping.	Severe: no water.	Slope, percs slowly.	Wetness, rooting depth, slope.	Slope, rooting depth, percs slowly.
HaB---------- Hartleton	Severe: seepage.	Severe: piping, large stones.	Severe: no water.	Deep to water	Large stones---	Large stones, droughty.
HaC, HaD---------- Hartleton	Severe: seepage, slope.	Severe: piping, large stones.	Severe: no water.	Deep to water	Slope, large stones.	Large stones, slope, droughty.
HbB---------- Hazleton	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, too sandy.	Large stones, droughty.
HbC---------- Hazleton	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Slope, large stones, too sandy.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
HdB---------- Hazleton	Severe: seepage.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, too sandy.	Large stones, droughty.
HdD---------- Hazleton	Severe: seepage, slope.	Severe: seepage, large stones.	Severe: no water.	Deep to water	Large stones, slope, too sandy.	Large stones, slope, droughty.
HeF*: Hartleton--------	Severe: seepage, slope.	Severe: piping, large stones.	Severe: no water.	Deep to water	Slope, large stones.	Large stones, slope, droughty.
Buchanan---------	Severe: slope.	Severe: piping, wetness.	Severe: no water.	Percs slowly, slope.	Slope, large stones, wetness.	Large stones, wetness, slope.
LeB---------- Leck Kill	Severe: seepage.	Moderate: thin layer.	Severe: no water.	Deep to water	Favorable------	Favorable.
LeC, LeD, LeF*---- Leck Kill	Severe: seepage, slope.	Moderate: thin layer.	Severe: no water.	Deep to water	Slope----------	Slope.
MeD---------- Meckesville	Severe: slope.	Severe: piping.	Severe: no water.	Slope----------	Slope, wetness.	Slope, rooting depth.
Pa---------- Palms	Severe: seepage.	Severe: excess humus, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Wetness.
Ph---------- Philo	Severe: seepage.	Severe: piping.	Moderate: deep to water.	Flooding-------	Wetness--------	Favorable.
Po---------- Pope	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
ReA---------- Rexford	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Wetness, percs slowly, rooting depth.	Percs slowly, wetness, rooting depth.
Sm*. Udorthents						
WaB---------- Wharton	Moderate: depth to rock, slope.	Moderate: thin layer, piping, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Wetness, percs slowly.	Percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AbB, AbC--------- Albrights	0-8	Silt loam---------	ML, CL	A-4	0-10	80-100	80-95	70-90	55-80	15-30	5-10
	8-19	Channery clay loam, gravelly silt loam, silty clay loam.	ML, CL, SM, SC	A-4, A-6	0-15	80-100	65-95	60-90	40-85	25-40	3-15
	19-70	Silt loam, gravelly silty clay loam, channery clay loam.	CL, ML, SC, SM-SC	A-4, A-2, A-6	0-15	65-100	45-95	40-90	25-80	20-40	3-15
AdC---------- Albrights	0-8	Silt loam---------	ML, CL, GM	A-4, A-2	3-15	65-100	60-90	55-85	50-80	15-30	1-10
	8-19	Channery clay loam, gravelly silt loam, silty clay loam.	ML, CL, SM, SC	A-4, A-6	0-15	80-100	65-95	60-90	40-85	25-40	3-15
	19-70	Silt loam, gravelly silty clay loam, channery clay loam.	CL, ML, SC, SM-SC	A-4, A-2, A-6	0-15	65-100	55-95	40-90	25-80	20-40	3-15
At---------- Atkins	0-7	Silt loam---------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	75-100	60-95	20-40	3-20
	7-35	Silty clay loam, silt loam, sandy loam.	SM, SC, ML, CL	A-4, A-6	0-5	90-100	85-100	65-100	45-85	20-40	3-20
	35-65	Stratified silty clay loam to gravelly sandy loam.	SM, CL, GM, ML	A-2, A-4, A-6	0-15	60-100	60-100	50-95	30-85	20-40	1-15
Ba---------- Barbour	0-7	Loam----------	ML, CL-ML, SM, SM-SC	A-4, A-2	0	80-100	75-100	50-95	30-90	15-25	2-7
	7-29	Silt loam, fine sandy loam, gravelly loam.	ML, SM, CL-ML, SM-SC	A-4, A-2, A-1	0	60-100	55-95	30-95	15-85	15-25	2-7
	29-60	Loamy sand, very gravelly sand, gravelly loamy fine sand.	SM, SP, GM, GP	A-1, A-2, A-3, A-4	0-5	35-95	30-95	20-80	2-40	---	NP
Bb---------- Basher	0-6	Silt loam---------	ML, CL-ML, SM, SM-SC	A-4, A-2, A-1	0-5	80-100	75-100	45-100	20-90	15-25	2-7
	6-20	Silt loam, loam, gravelly sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2, A-1	0-5	75-100	70-100	40-100	20-90	15-25	2-7
	20-41	Silt loam, gravelly loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2, A-1	0-5	75-100	70-100	40-100	20-90	15-25	2-7
	41-73	Fine sandy loam, gravelly loamy sand, very gravelly sand.	GP, SW, SM, ML	A-1, A-2, A-4, A-3	0-5	30-100	25-100	10-85	1-55	---	NP

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BeB----------	0-7	Silt loam--------	ML, CL, SM	A-4, A-2	0-15	95-100	80-100	75-100	30-90	15-30	NP-10
Braceville	7-18	Gravelly sandy loam, silt loam, gravelly loam.	ML, SM, GM-GC, CL-ML	A-2, A-4, A-1	0-10	65-100	60-100	40-100	20-90	15-35	NP-10
	18-37	Gravelly sandy loam, gravelly silt loam.	ML, SM, GM-GC, CL-ML	A-2, A-4, A-1	0-10	65-100	40-75	25-75	15-65	15-35	NP-10
	37-63	Stratified sand and gravel.	GM, SM, GW-GM, GP-GM	A-1, A-2, A-4	0-15	40-100	35-100	25-90	10-50	<30	NP-5
BrA, BrB---------	0-9	Silt loam--------	ML	A-4, A-6	0-10	90-100	85-100	85-100	75-100	---	---
Brinkerton	9-20	Silty clay loam, silt loam.	ML	A-4, A-6, A-7, A-5	0-10	90-100	85-100	85-100	65-100	30-45	5-15
	20-44	Silt loam, shaly loam, channery silty clay loam.	ML	A-4, A-6, A-7, A-5	0-10	75-100	60-100	60-100	55-100	30-45	5-15
	44-60	Silt loam, shaly loam, channery silt loam.	ML, SM, SC, CL	A-4, A-6, A-2, A-1	0-50	70-90	25-85	25-85	20-75	30-40	5-15
BsB----------	0-9	Silt loam--------	ML	A-4, A-6	3-20	90-100	85-100	85-100	75-100	---	---
Brinkerton	9-20	Silty clay loam, silt loam.	ML	A-4, A-6, A-7, A-5	0-10	90-100	85-100	85-100	65-100	30-45	5-15
	20-44	Silt loam, shaly loam, channery silty clay loam.	ML	A-4, A-6, A-7, A-5	0-10	75-100	60-100	60-100	55-100	30-45	5-15
	44-60	Silt loam, shaly loam, channery silt loam.	ML, SM, SC, CL	A-4, A-6, A-2, A-1	0-50	70-90	25-85	25-85	20-75	30-40	5-15
BuB, BuC---------	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-90	48-85	20-35	2-11
Buchanan	8-26	Gravelly loam, silt loam, gravelly sandy clay loam.	GM, ML, CL, SM	A-4, A-2, A-6	0-20	50-100	45-90	40-90	20-80	20-35	2-15
	26-83	Gravelly loam, silt loam, channery clay loam.	GM, ML, CL, SM	A-4, A-2, A-6	0-20	50-100	30-80	30-75	20-60	20-35	2-15
BxB, BxD---------	0-8	Silt loam-------- loam.	GM, ML, CL, CL-ML	A-2, A-4, A-6	3-20	50-90	45-75	40-75	30-65	20-35	2-11
Buchanan	8-26	Gravelly loam, silt loam, gravelly sandy clay loam.	GM, ML, CL, SM	A-2, A-4, A-6	0-20	50-100	45-90	40-90	20-80	20-35	2-15
	26-83	Gravelly loam, loam, channery clay loam.	GM, ML, CL, SM	A-2, A-4, A-6	0-20	50-100	30-80	30-75	20-60	20-35	2-15
CaA, CaB---------	0-7	Silt loam--------	ML, CL	A-4	0-5	90-100	80-100	80-95	75-95	---	---
Cavode	7-47	Silty clay loam, silty clay, clay.	ML, CL, CL-ML	A-4, A-7, A-6	0-5	85-100	80-100	80-95	70-95	25-50	4-20
	47-71	Shaly silty clay loam, silty clay, clay.	ML, CL, GC, GM	A-2, A-4, A-6	0-45	50-100	35-100	30-80	25-75	25-45	2-15
	71-75	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ChB---------- Chenango	0-7	Gravelly loam----	ML, SM, GM	A-2, A-4, A-1	5-15	55-85	55-80	35-80	15-70	<35	NP-10
	7-31	Gravelly silt loam, gravelly fine sandy loam, very gravelly silt loam.	ML, GM, SM	A-2, A-4, A-1	5-10	35-80	30-75	25-75	15-65	<40	NP-10
	31-80	Very gravelly loamy coarse sand, very gravelly sand, gravelly loamy fine sand.	GW, GM, SM, GP	A-1	5-10	25-65	20-60	10-50	1-20	---	NP
ClB---------- Clymer	0-10	Loam----------	ML, SM	A-4	0-5	85-100	75-95	60-90	35-85	10-30	NP-9
	10-31	Sandy loam, channery loam, channery clay loam.	GM, SM, GC, ML	A-2, A-4	0-20	60-95	50-95	45-85	30-60	14-32	NP-9
	31-48	Channery loam, very channery loam, channery sandy loam.	GM, GP-GM, GC, SM	A-1, A-2, A-3, A-4	10-30	30-75	25-70	20-60	5-40	14-32	NP-9
	48-52	Weathered bedrock	---	---	---	---	---	---	---	---	---
CoA, CoB, CoC---- Cookport	0-9	Loam----------	ML, CL, SM, SC	A-2, A-4, A-6	0-5	85-100	80-100	60-85	30-85	20-40	1-15
	9-21	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	21-39	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	39-45	Very channery sandy loam, channery loam.	ML, CL, SM-SC, GM-GC	A-2, A-4, A-6	0-15	60-100	50-95	40-95	30-75	20-40	1-15
	45-49	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CpB, CpD---------- Cookport	0-9	Loam----------	ML, CL, SM, SC	A-2, A-4, A-6	2-40	75-95	60-70	50-60	30-55	20-40	1-15
	9-21	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	21-39	Sandy clay loam, clay loam, channery loam.	ML, CL, SM, SC	A-4, A-6	0-15	85-100	65-100	55-95	40-75	20-40	4-20
	39-45	Very channery sandy loam, channery loam.	ML, CL, SM-SC, GM-GC	A-2, A-4, A-6	0-15	60-100	50-95	40-95	30-75	20-40	1-15
	45-49	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HaB, HaC, HaD---- Hartleton	0-11	Channery silt loam.	SM, ML	A-4	10-20	80-95	70-90	60-90	45-80	---	---
	11-39	Channery silt loam, very channery loam, channery silty clay loam.	GM, ML, SM	A-2, A-4	25-65	60-90	45-80	40-80	30-75	20-30	NP-7
	39-57	Very channery loam, very shaly silt loam.	SM, GM, ML	A-1, A-2, A-4	55-85	40-80	25-70	20-70	15-60	20-30	NP-7
	57-61	Weathered bedrock	---	---	---	---	---	---	---	---	---
HbB, HbC--------- Hazleton	0-6	Channery loam----	ML, GM, SM	A-2, A-4	0-15	60-85	60-80	60-75	35-55	---	---
	6-34	Channery sandy loam, loam, very channery loam.	GM, SM, ML, SC	A-2, A-4, A-1	0-50	60-95	45-90	35-70	20-55	<30	NP-8
	34-43	Channery loam, very channery sandy loam, very channery loamy sand.	GM, SM, SC, GC	A-2, A-1, A-4	0-60	55-80	35-75	25-65	15-50	<30	NP-8
	43-47	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HdB, HdD--------- Hazleton	0-6	Channery loam----	ML, GM, SM	A-4, A-2	5-15	60-85	50-80	50-70	35-55	---	---
	6-34	Channery sandy loam, channery loam, loam.	GM, SM, ML, SC	A-2, A-4, A-1	0-50	60-95	45-90	35-70	20-55	<30	NP-8
	34-43	Channery loam, very channery sandy loam, very channery loamy sand.	GM, SM, SC, GC	A-2, A-1, A-4	5-60	50-80	35-75	25-65	15-50	<30	NP-8
	43-47	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HeF*: Hartleton-------	0-11	Channery silt loam.	SM, ML	A-4	10-20	80-95	70-90	60-90	45-80	---	---
	11-39	Channery silt loam, very channery loam, channery silty clay loam.	GM, ML, SM	A-2, A-4	25-65	60-90	45-80	40-80	30-75	20-30	NP-7
	39-57	Very channery loam, very shaly silt loam.	SM, GM, ML	A-1, A-2, A-4	55-85	40-80	25-70	20-70	15-60	20-30	NP-7
	57-61	Weathered bedrock	---	---	---	---	---	---	---	---	---
Buchanan--------	0-8	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-90	48-85	20-35	2-11
	8-26	Gravelly loam, silt loam, gravelly sandy clay loam.	GM, ML, CL, SM	A-4, A-2, A-6	0-20	50-100	45-90	40-90	20-80	20-35	2-15
	26-83	Gravelly loam, silt loam, channery clay loam.	GM, ML, CL, SM	A-4, A-2, A-6	0-20	50-100	30-80	30-75	20-60	20-35	2-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
LeB, LeC, LeD, LeF*---------- Leck Kill	0-6	Channery silt loam.	SM, ML, GM	A-2, A-4	0-5	70-85	60-80	50-80	35-70	---	---
	6-26	Silt loam, channery loam, shaly silty clay loam.	GM, SC, GC, CL	A-4, A-2, A-6	0-10	60-90	50-85	40-80	30-70	23-40	2-17
	26-44	Very channery silt loam, very channery clay loam, very shaly loam.	SM, GM, GP-GM, SP-SM	A-2, A-1	0-30	30-70	10-30	8-30	6-25	25-40	2-13
	44-48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MeD---------- Meckesville	0-9	Channery silt loam.	ML	A-4	0-10	90-100	85-95	70-85	55-70	30-40	5-10
	9-24	Loam, channery silt loam, gravelly silty clay loam.	ML, CL	A-4, A-6	0-20	60-100	60-95	60-90	55-70	25-40	2-15
	24-51	Loam, channery silt loam, gravelly clay loam.	ML, CL-ML, GM, SC	A-4, A-2	0-20	45-95	40-90	35-85	30-65	20-30	2-10
	51-66	Loam, channery silt loam, gravelly clay loam.	ML, CL-ML, GM, SC	A-4, A-2	0-50	45-90	30-85	30-85	25-60	20-30	2-10
Pa---------- Palms	0-40	Muck----------	PT	A-8	---	---	---	---	---	---	---
	40-60	Clay loam, silty clay loam, fine sandy loam.	CL-ML, CL	A-4, A-6	0	85-100	80-100	70-95	50-90	25-40	5-20
Ph---------- Philo	0-7	Silt loam--------	ML, CL-ML	A-4	0-5	95-100	80-100	85-90	60-80	20-35	1-10
	7-46	Silt loam, loam, sandy loam.	ML, SM, CL-ML	A-4	0-5	95-100	75-100	70-90	45-80	20-35	1-10
	46-66	Stratified sand to silt loam.	GM, SM, ML, CL-ML	A-2, A-4	0-5	60-95	50-90	40-85	30-80	15-30	1-10
Po---------- Pope	0-6	Loam----------	ML, CL, SM, CL-ML	A-4	0	85-100	75-100	70-100	45-90	<30	NP-10
	6-41	Fine sandy loam, sandy loam, loam.	SM, SM-SC, ML, CL-ML	A-2, A-4	0	95-100	80-100	51-95	25-75	<30	NP-7
	41-65	Sandy loam, loamy sand.	SM, SM-SC, ML, GM	A-2, A-1, A-4	0-20	45-100	35-100	30-95	15-70	<30	NP-7
ReA---------- Rexford	0-18	Silt loam--------	ML, CL, SM, SC	A-4, A-2	0-5	95-100	80-100	75-95	30-90	15-35	NP-10
	18-39	Gravelly sandy loam, loam, silt loam.	ML, SM, GM	A-2, A-4	0-10	60-100	50-100	40-85	25-70	20-35	NP-5
	39-47	Gravelly sandy loam, loam, silt loam.	ML, SM, GM	A-2, A-4	0-15	60-90	50-80	35-65	25-55	<30	NP-10
	47-60	Stratified sand to gravel.	GP-GM, SP-SM, GW, SP	A-1, A-2	0-20	40-55	30-50	10-40	4-35	---	NP

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Sm*. Udorthents											
WaB---------- Wharton	0-7	Silt loam--------	ML, CL	A-4, A-6	0-5	95-100	90-100	80-95	70-90	---	---
	7-43	Clay loam, shaly silty clay loam, shaly silt loam.	ML, CL	A-7, A-6	0-25	75-100	70-100	65-95	60-90	35-45	10-25
	43-53	Silt loam, shaly clay, very shaly silt loam.	ML, GM, SM	A-4, A-6, A-7, A-2	0-50	45-100	30-100	25-95	25-90	30-45	5-15
	53-57	Weathered bedrock	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
AbB, AbC----------	0-8	15-27	1.20-1.40	0.6-2.0	0.16-0.20	3.6-5.5	Low----------	0.32	3-2	1-4
Albrights	8-19	18-35	1.30-1.50	0.6-2.0	0.10-0.14	4.5-6.0	Low----------	0.28		
	19-70	18-35	1.40-1.70	0.2-0.6	0.04-0.08	4.5-6.0	Low----------	0.28		
AdC----------	0-8	15-27	1.20-1.40	0.6-2.0	0.14-0.18	3.6-5.5	Low----------	0.24	3-2	---
Albrights	8-19	18-35	1.30-1.50	0.6-2.0	0.10-0.14	3.6-6.0	Low----------	0.28		
	19-70	18-35	1.40-1.70	0.2-0.6	0.04-0.08	4.5-6.0	Low----------	0.28		
At----------	0-7	18-30	1.20-1.40	0.6-2.0	0.14-0.22	4.5-5.5	Low----------	0.32	4	2-4
Atkins	7-35	18-35	1.20-1.50	0.06-2.0	0.14-0.18	4.5-5.5	Low----------	0.32		
	35-65	10-35	1.20-1.50	0.2-6.0	0.08-0.18	4.5-5.5	Low----------	0.28		
Ba----------	0-7	6-18	1.15-1.40	0.6-2.0	0.16-0.21	4.5-6.0	Low----------	0.32	5	1-5
Barbour	7-29	6-18	1.15-1.45	2.0-6.0	0.10-0.19	4.5-6.0	Low----------	0.32		
	29-60	1-8	1.25-1.55	6.0-20	0.02-0.07	4.5-6.5	Low----------	0.17		
Bb----------	0-6	6-18	1.15-1.40	0.6-2.0	0.15-0.21	3.6-6.0	Low----------	0.32	5	1-5
Basher	6-20	6-18	1.15-1.45	0.6-2.0	0.10-0.19	3.6-6.0	Low----------	0.32		
	20-41	6-18	1.25-1.55	0.2-2.0	0.10-0.19	4.5-6.5	Low----------	0.32		
	41-73	1-8	1.25-1.55	0.6-6.0	0.02-0.07	4.5-6.5	Low----------	0.17		
BeB----------	0-7	10-25	1.20-1.40	0.2-2.0	0.08-0.16	4.5-6.0	Low----------	0.24	3	1-3
Braceville	7-18	10-25	1.20-1.50	0.2-2.0	0.08-0.12	4.5-6.0	Low----------	0.20		
	18-37	10-25	1.30-1.60	0.06-0.6	0.06-0.10	5.1-6.5	Low----------	0.20		
	37-63	5-25	1.20-1.40	2.0-20	0.03-0.06	5.1-6.5	Low----------	0.20		
BrA, BrB----------	0-9	15-30	1.20-1.40	0.6-2.0	0.18-0.24	4.5-6.0	Low----------	0.32	3	1-4
Brinkerton	9-20	15-35	1.20-1.50	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.37		
	20-44	15-35	1.40-1.70	0.06-0.6	0.08-0.12	4.5-6.0	Moderate-----	0.32		
	44-60	15-25	1.20-1.60	0.06-0.6	0.14-0.18	5.1-6.5	Low----------	0.20		
BsB----------	0-9	15-35	1.20-1.40	0.6-2.0	0.18-0.24	4.5-6.0	Low----------	0.24	3-2	---
Brinkerton	9-20	15-35	1.20-1.50	0.6-2.0	0.14-0.18	4.5-6.0	Moderate-----	0.37		
	20-44	15-35	1.40-1.70	0.06-0.6	0.08-0.12	4.5-6.0	Moderate-----	0.32		
	44-60	15-25	1.20-1.60	0.06-0.6	0.14-0.18	5.1-6.5	Low----------	0.20		
BuB, BuC----------	0-8	10-27	1.20-1.40	0.6-2.0	0.14-0.20	3.6-5.5	Low----------	0.32	3-2	1-3
Buchanan	8-26	18-30	1.30-1.60	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.24		
	26-83	18-35	1.40-1.70	0.06-0.2	0.06-0.10	3.6-5.5	Low----------	0.17		
BxB, BxD----------	0-8	10-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low----------	0.24	3-2	.5-2
Buchanan	8-26	18-30	1.30-1.60	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.24		
	26-83	18-35	1.40-1.70	0.06-0.2	0.06-0.10	3.6-5.5	Low----------	0.17		
CaA, CaB----------	0-7	15-35	1.20-1.40	0.6-2.0	0.18-0.22	4.5-5.5	Low----------	0.37	3	2-4
Cavode	7-47	35-45	1.20-1.50	0.06-0.2	0.10-0.14	4.5-5.5	Moderate-----	0.24		
	47-71	35-45	1.20-1.50	0.06-0.2	0.08-0.12	4.5-5.5	Moderate-----	0.24		
	71-75	---	---	---	---	---	----------	----		
ChB----------	0-7	6-18	1.20-1.50	0.6-6.0	0.08-0.16	4.5-5.5	Low----------	0.24	3	2-6
Chenango	7-31	6-18	1.25-1.55	0.6-6.0	0.07-0.15	4.5-6.0	Low----------	0.17		
	31-80	1-8	1.45-1.65	6.0-20	0.01-0.05	5.1-7.3	Low----------	0.17		
ClB----------	0-10	15-27	1.20-1.40	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.24	3	1-4
Clymer	10-31	18-30	1.20-1.50	0.6-2.0	0.08-0.14	3.6-5.5	Low----------	0.15		
	31-48	15-27	1.20-1.40	0.6-2.0	0.04-0.08	3.6-5.5	Low----------	0.15		
	48-52	---	---	---	---	---	----------	----		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
CoA, CoB, CoC----	0-9	10-27	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.32	3	1-4
Cookport	9-21	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	21-39	18-35	1.40-1.70	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.24		
	39-45	10-27	1.20-1.50	0.2-0.6	0.08-0.12	3.6-5.5	Low----------	0.24		
	45-49	---	---	---	---	---	----------	----		
CpB, CpD----------	0-9	10-27	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24	3	---
Cookport	9-21	18-35	1.20-1.50	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	21-39	18-35	1.40-1.70	0.06-0.2	0.08-0.12	3.6-5.5	Low----------	0.24		
	39-45	10-27	1.20-1.50	0.2-0.6	0.08-0.12	3.6-5.5	Low----------	0.24		
	45-49	---	---	---	---	---	----------	----		
HaB, HaC, HaD----	0-11	10-25	1.20-1.40	0.6-6.0	0.10-0.14	4.5-5.5	Low----------	0.20	3	1-3
Hartleton	11-39	15-27	1.40-1.60	0.6-6.0	0.06-0.10	4.5-5.5	Low----------	0.20		
	39-57	15-27	1.40-1.60	0.6-6.0	0.04-0.08	4.5-5.5	Low----------	0.20		
	57-61	---	---	---	---	---	----------	----		
HbB, HbC----------	0-6	7-18	1.20-1.40	2.0-6.0	0.10-0.14	3.6-5.5	Low----------	0.17	3	2-4
Hazleton	6-34	7-18	1.20-1.40	2.0-20	0.08-0.12	3.6-5.5	Low----------	0.15		
	34-43	5-15	1.20-1.40	2.0-20	0.06-0.12	3.6-5.5	Low----------	0.15		
	43-47	---	---	---	---	---	----------	----		
HdB, HdD----------	0-6	7-18	1.20-1.40	2.0-6.0	0.10-0.16	3.6-5.5	Low----------	0.15	3	2-4
Hazleton	6-34	7-18	1.20-1.40	2.0-20	0.08-0.12	3.6-5.5	Low----------	0.15		
	34-43	5-15	1.20-1.40	2.0-20	0.06-0.12	3.6-5.5	Low----------	0.15		
	43-47	---	---	---	---	---	----------	----		
HeF*:										
Hartleton--------	0-11	10-25	1.20-1.40	0.6-6.0	0.10-0.14	4.5-5.5	Low----------	0.20	3	1-3
	11-39	15-27	1.40-1.60	0.6-6.0	0.06-0.10	4.5-5.5	Low----------	0.20		
	39-57	15-27	1.40-1.60	0.6-6.0	0.04-0.08	4.5-5.5	Low----------	0.20		
	57-61	---	---	---	---	---	----------	----		
Buchanan---------	0-8	10-27	1.20-1.40	0.6-2.0	0.14-0.20	3.6-5.5	Low----------	0.32	3-2	1-3
	8-26	18-30	1.30-1.60	0.6-2.0	0.10-0.16	3.6-5.5	Low----------	0.24		
	26-83	18-35	1.40-1.70	0.06-0.2	0.06-0.10	3.6-5.5	Low----------	0.17		
LeB, LeC, LeD,										
LeF*------------	0-6	10-20	1.20-1.50	0.6-6.0	0.14-0.18	4.5-7.3	Low----------	0.24	3	1-3
Leck Kill	6-26	17-32	1.40-1.70	0.6-6.0	0.12-0.16	4.5-7.3	Low----------	0.24		
	26-44	17-32	1.30-1.60	0.6-6.0	0.04-0.08	4.5-6.0	Low----------	0.17		
	44-48	---	---	---	---	---	----------	----		
MeD---------------	0-9	10-27	1.10-1.30	0.6-2.0	0.14-0.18	3.6-5.5	Low----------	0.32	4	1-4
Meckesville	9-24	18-35	1.20-1.40	0.6-2.0	0.12-0.16	3.6-5.5	Low----------	0.24		
	24-51	18-35	1.30-1.60	0.2-0.6	0.08-0.12	3.6-5.5	Low----------	0.24		
	51-66	10-35	1.20-1.40	0.2-0.6	0.08-0.12	3.6-5.5	Low----------	0.24		
Pa----------------	0-40	---	0.25-0.45	0.2-6.0	0.35-0.45	6.1-7.3	----------	----	2	>75
Palms	40-60	7-35	1.45-1.75	0.2-2.0	0.14-0.22	6.1-7.3	Low----------	----		
Ph----------------	0-7	10-18	1.20-1.40	0.6-2.0	0.14-0.20	4.5-6.0	Low----------	0.37	5	2-4
Philo	7-46	10-18	1.20-1.40	0.6-2.0	0.10-0.20	4.5-6.0	Low----------	0.32		
	46-66	5-18	1.20-1.40	2.0-6.0	0.06-0.10	4.5-6.0	Low----------	0.24		
Po----------------	0-6	5-15	1.20-1.40	0.6-2.0	0.14-0.23	3.6-5.5	Low----------	0.37	5	1-4
Pope	6-41	5-18	1.30-1.60	0.6-6.0	0.10-0.18	3.6-5.5	Low----------	0.28		
	41-65	5-20	1.30-1.60	0.6-6.0	0.10-0.18	3.6-5.5	Low----------	0.28		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
ReA----------	0-18	10-20	1.2-1.4	0.6-2.0	0.14-0.18	4.5-6.0	Low----------	0.24	3	1-3
Rexford	18-39	10-18	1.2-1.5	0.06-0.2	0.04-0.08	5.1-6.5	Low----------	0.20		
	39-47	10-18	1.3-1.6	0.2-2.0	0.04-0.08	5.1-6.5	Low----------	0.20		
	47-60	5-15	1.2-1.4	>2.0	0.03-0.06	5.1-6.5	Low----------	0.20		
Sm*.										
Udorthents										
WaB----------	0-7	15-25	1.10-1.30	0.6-2.0	0.16-0.20	4.0-5.5	Low----------	0.37	3	1-4
Wharton	7-43	15-35	1.20-1.50	0.06-0.6	0.12-0.16	5.1-5.5	Moderate-----	0.24		
	43-53	20-45	1.20-1.60	0.06-0.6	0.08-0.12	5.1-5.5	Moderate-----	0.17		
	53-57	---	---	---	---	---	----------	----		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
AbB, AbC, AdC---- Albrights	C	None-------	---	---	1.0-2.5	Perched	Nov-Mar	>60	---	Moderate	High-----	High.
At---------- Atkins	D	Frequent----	Very brief	Sep-Jul	0-1.0	Apparent	Nov-Jun	>60	---	High-----	High-----	Moderate.
Ba---------- Barbour	B	Occasional	Brief to long.	Dec-Apr	3.0-6.0	Apparent	Jan-Apr	>60	---	Moderate	Low------	Moderate.
Bb---------- Basher	B	Occasional	Brief to long.	Dec-Apr	1.0-2.0	Apparent	Jan-May	>60	---	High-----	Moderate	Moderate.
BeB---------- Braceville	C	None-------	---	---	1.0-3.0	Perched	Nov-Mar	>60	---	Moderate	Moderate	Moderate.
BrA, BrB, BsB---- Brinkerton	D	None-------	---	---	0-0.5	Perched	Oct-May	>60	---	High-----	High-----	High.
BuB, BuC, BxB, BxD---------- Buchanan	C	None-------	---	---	0.5-3.0	Perched	Nov-Mar	>60	---	Moderate	High-----	High.
CaA, CaB---------- Cavode	C	None-------	---	---	0.5-1.5	Perched	Oct-May	50-72	Soft	High-----	High-----	High.
ChB---------- Chenango	A	None-------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Moderate.
ClB---------- Clymer	B	None-------	---	---	>6.0	---	---	42-84	Hard	Moderate	Low------	High.
CoA, CoB, CoC, CpB, CpD--------- Cookport	C	None-------	---	---	1.5-2.5	Perched	Dec-Apr	42-72	Hard	Moderate	Moderate	Moderate.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
HaB, HaC, HaD----- Hartleton	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Low------	High.
HbB, HbC, HdB, HdD---------- Hazleton	B	None--------	---	---	>6.0	---	---	>40	Hard	Moderate	Low------	High.
HeF*: Hartleton--------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Low------	High.
Buchanan---------	C	None--------	---	---	0.5-3.0	Perched	Nov-Mar	>60	---	Moderate	High-----	High.
LeB, LeC, LeD, LeF*---------- Leck Kill	B	None--------	---	---	>6.0	---	---	42-60	Soft	Moderate	Low------	Moderate.
MeD---------- Meckesville	C	None--------	---	---	2.5-4.0	Perched	Nov-Apr	>60	---	Moderate	Moderate	High.
Pa---------- Palms	A/D	Frequent----	---	---	+1-1.0	Apparent	Nov-May	>60	---	High-----	High-----	Moderate.
Ph---------- Philo	B	Occasional	Very brief	Dec-May	1.5-3.0	Apparent	Dec-Apr	>60	Hard	Moderate	Low------	High.
Po---------- Pope	B	Occasional	Very brief to brief.	Nov-Apr	>6.0	---	---	>60	---	Moderate	Low------	High.
ReA---------- Rexford	C	None--------	---	---	0-1.5	Perched	Oct-May	>60	---	High-----	High-----	High.
Sm*. Udorthents												
WaB---------- Wharton	C	None--------	---	---	1.5-3.0	Perched	Nov-Mar	40-72	Soft	High-----	High-----	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Albrights	Fine-loamy, mixed, mesic Aquic Fragiudalfs
Atkins	Fine-loamy, mixed, acid, mesic Typic Fluvaquents
Barbour	Coarse-loamy over sandy or sandy-skeletal, mixed, mesic Fluventic Dystrochrepts
Basher	Coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts
Braceville	Coarse-loamy, mixed, mesic Typic Fragiochrepts
Brinkerton	Fine-silty, mixed, mesic Typic Fragiaqualfs
Buchanan	Fine-loamy, mixed, mesic Aquic Fragiudults
Cavode	Clayey, mixed, mesic Aeric Ochraquults
Chenango	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Clymer	Fine-loamy, mixed, mesic Typic Hapludults
Cookport	Fine-loamy, mixed, mesic Aquic Fragiudults
Hartleton	Loamy-skeletal, mixed, mesic Typic Hapludults
Hazleton	Loamy-skeletal, mixed, mesic Typic Dystrochrepts
Leck Kill	Fine-loamy, mixed, mesic Typic Hapludults
Meckesville	Fine-loamy, mixed, mesic Typic Fragiudults
Palms	Loamy, mixed, euic, mesic Terric Medisaprists
Philo	Coarse-loamy, mixed, mesic Fluvaquentic Dystrochrepts
Pope	Coarse-loamy, mixed, mesic Fluventic Dystrochrepts
Rexford	Coarse-loamy, mixed, mesic Aeric Fragiaquepts
Udorthents	Udorthents
Wharton	Fine-loamy, mixed, mesic Aquic Hapludults

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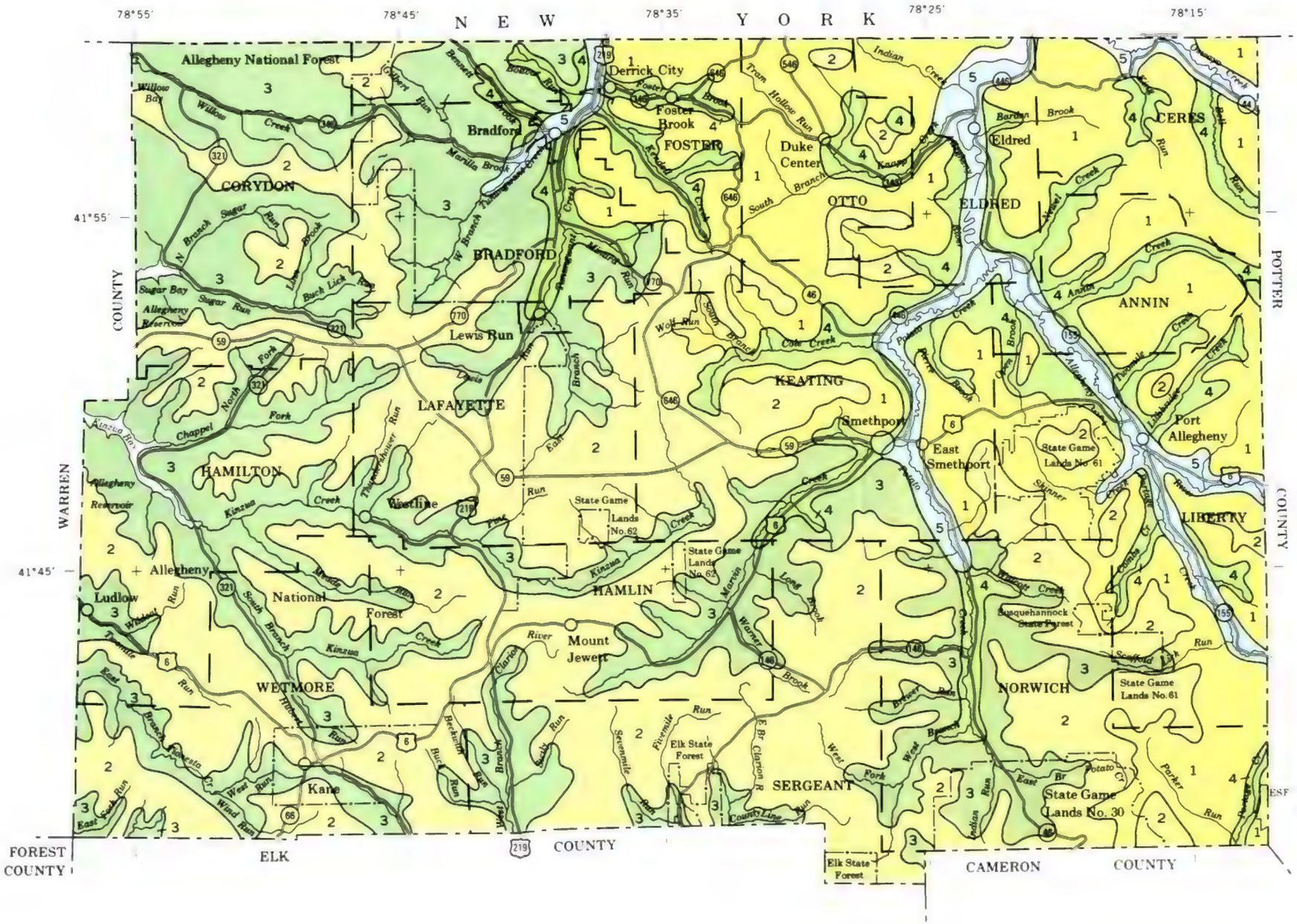

LEGEND

1	BUCHANAN-HARTLETON-LECK KILL: Very deep and deep, somewhat poorly drained to well drained, moderately steep to very steep soils; formed in materials weathered from sandstone and shale; on uplands
2	COOKPORT-HAZLETON: Deep and very deep, moderately well drained and well drained, nearly level to moderately steep soils; formed in materials weathered from sandstone and shale; on uplands
3	BUCHANAN-HARTLETON-HAZLETON: Very deep and deep, somewhat poorly drained to well drained, nearly level to very steep soils; formed in materials weathered from sandstone and shale; on uplands
4	ALBRIGHTS-BUCHANAN: Very deep, moderately well drained and somewhat poorly drained, nearly level to moderately steep soils; formed in materials weathered from sandstone and shale; on uplands
5	PHILO-ATKINS-BASHER: Very deep, poorly drained to well drained, nearly level soils; formed in water-deposited materials derived from sandstone and shale; on flood plains

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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
AGRICULTURAL EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
PENNSYLVANIA STATE UNIVERSITY
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
PENNSYLVANIA DEPARTMENT OF AGRICULTURE

GENERAL SOIL MAP

McKEAN COUNTY, PENNSYLVANIA

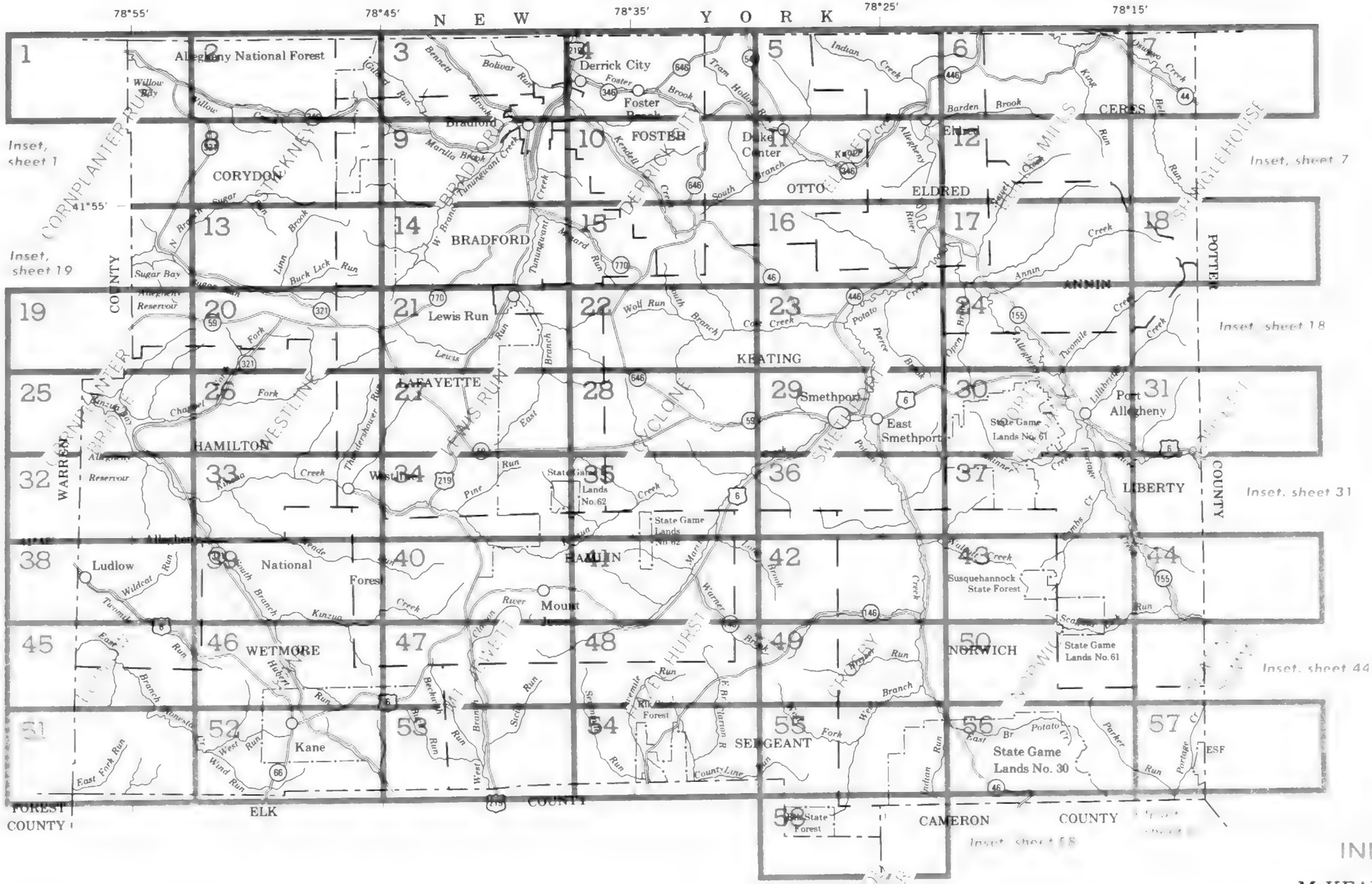
Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

N

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

McKEAN COUNTY, PENNSYLVANIA

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km

N

Original text from each individual map sheet read:

This soil survey map was compiled by U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by U.S. Department of the Interior, Geological Survey from 1977 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

McKEAN COUNTY, PENNSYLVANIA

AGRICULTURAL EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
PENNSYLVANIA STATE UNIVERSITY
PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES
PENNSYLVANIA DEPARTMENT OF AGRICULTURE

SOIL LEGEND

Publication symbols consist of upper and lower case letters. The first letter, always upper case, is the initial letter of the soil name. The lower case letter that follows separates map units having names that begin with the same letter, except that it does not separate slope phases. The third letter, always a capital, A, B, C, D, or F indicates the slope class. Most symbols without a slope letter are those of nearly level soils, however, some are for soils that have a considerable range of slope, but have similar use interpretations regardless of slope.

SYMBOL	NAME
AbB	Albrights silt loam, 3 to 8 percent slopes
AbC	Albrights silt loam, 8 to 15 percent slopes
AdC	Albrights silt loam, 8 to 15 percent slopes, very stony
At	Atkins silt loam
Ba	Barbour loam
Bb	Basher silt loam
BeB	Braceville silt loam, 3 to 8 percent slopes
BrA	Brinkerton silt loam, 0 to 3 percent slopes
BrB	Brinkerton silt loam, 3 to 8 percent slopes
BsB	Brinkerton silt loam, 0 to 8 percent slopes, very stony
BuB	Buchanan silt loam, 3 to 8 percent slopes
BuC	Buchanan silt loam, 8 to 15 percent slopes
BxB	Buchanan silt loam, 0 to 8 percent slopes, very stony
BxD	Buchanan silt loam, 8 to 25 percent slopes, very stony
CaA	Cavode silt loam, 0 to 3 percent slopes
CaB	Cavode silt loam, 3 to 8 percent slopes
ChB	Chenango gravelly loam, 3 to 8 percent slopes
ClB	Clymer loam, 3 to 8 percent slopes
CoA	Cookport loam, 0 to 3 percent slopes
CoB	Cookport loam, 3 to 8 percent slopes
CoC	Cookport loam, 8 to 15 percent slopes
CpB	Cookport loam, 0 to 8 percent slopes, very stony
CpD	Cookport loam, 8 to 25 percent slopes, very stony
HaB	Hartleton channery silt loam, 3 to 8 percent slopes
HaC	Hartleton channery silt loam, 8 to 15 percent slopes
HaD	Hartleton channery silt loam, 15 to 25 percent slopes
HeF	Hartleton and Buchanan soils, 25 to 60 percent slopes
HbB	Hazleton channery loam, 3 to 8 percent slopes
HbC	Hazleton channery loam, 8 to 15 percent slopes
HdB	Hazleton channery loam, 0 to 8 percent slopes, very stony
HdD	Hazleton channery loam, 8 to 25 percent slopes, very stony
LeB	Leck Kill channery silt loam, 3 to 8 percent slopes
LeC	Leck Kill channery silt loam, 8 to 15 percent slopes
LeD	Leck Kill channery silt loam, 15 to 25 percent slopes
LeF	Leck Kill channery silt loam, 25 to 50 percent slopes
MeD	Meckesville channery silt loam, 15 to 25 percent slopes
Pa	Palms muck
Ph	Philo silt loam
Po	Pope loam
ReA	Rexford silt loam, 0 to 3 percent slopes
Sm	Udorthents, extremely channery
WaB	Wharton silt loam, 3 to 8 percent slopes
W	Water

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline
- AD HOC BOUNDARY (label)
- Small airport, airfield, park, oilfield, cemetery, or flood pool
- STATE COORDINATE TICK
- LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

- RAILROAD
- POWER TRANSMISSION LINE (normally not shown)
- PIPE LINE (normally not shown)
- FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
- Double-line (label)
- Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

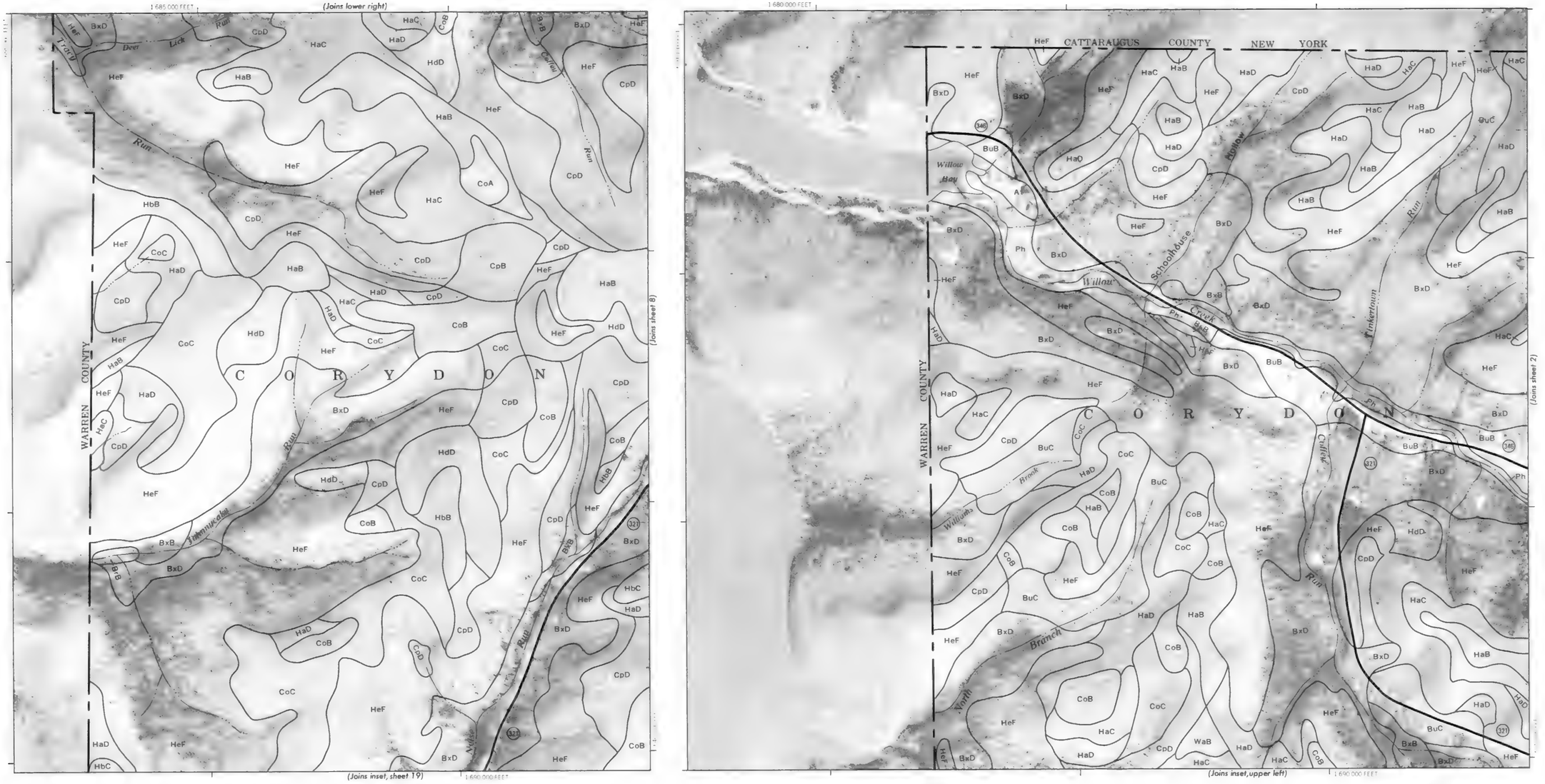
- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

- SOIL DELINEATIONS AND SYMBOLS
- ESCARPMENTS
  - Bedrock (points down slope)
  - Other than bedrock (points down slope)
- SHORT STEEP SLOPE
- GULLY
- DEPRESSION OR SINK
- SOIL SAMPLE SITE (normally not shown)
- MISCELLANEOUS
  - Blowout
  - Clay spot
  - Gravelly spot
  - Gumbo, slick or scabby spot (sodic)
  - Dumps and other similar non soil areas
  - Prominent hill or peak
  - Rock outcrop (includes sandstone and shale)
  - Saline spot
  - Sandy spot
  - Severely eroded spot
  - Slide or slip (tips point upslope)
  - Stony spot, very stony spot

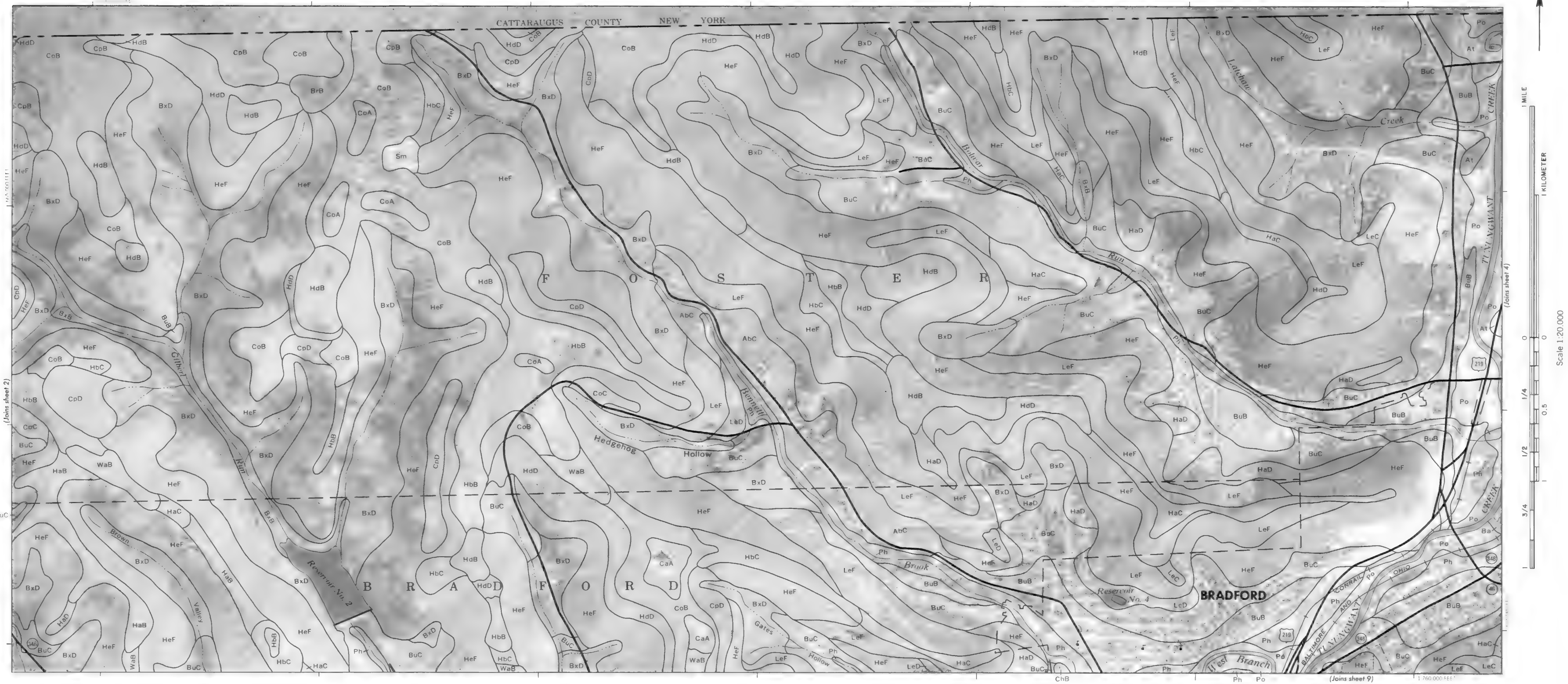
INSET

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 1



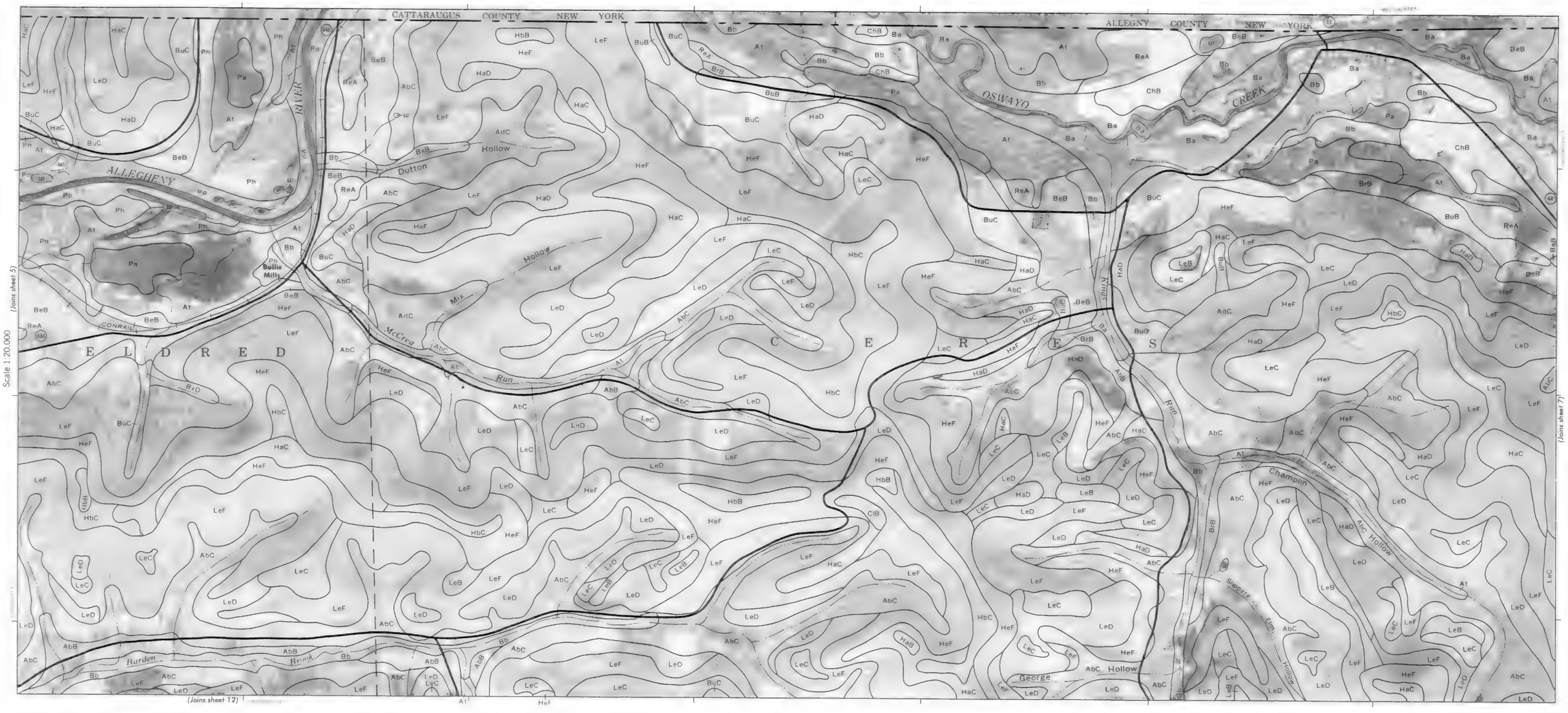
1 MILE
1 KILOMETER
Scale 1:20,000

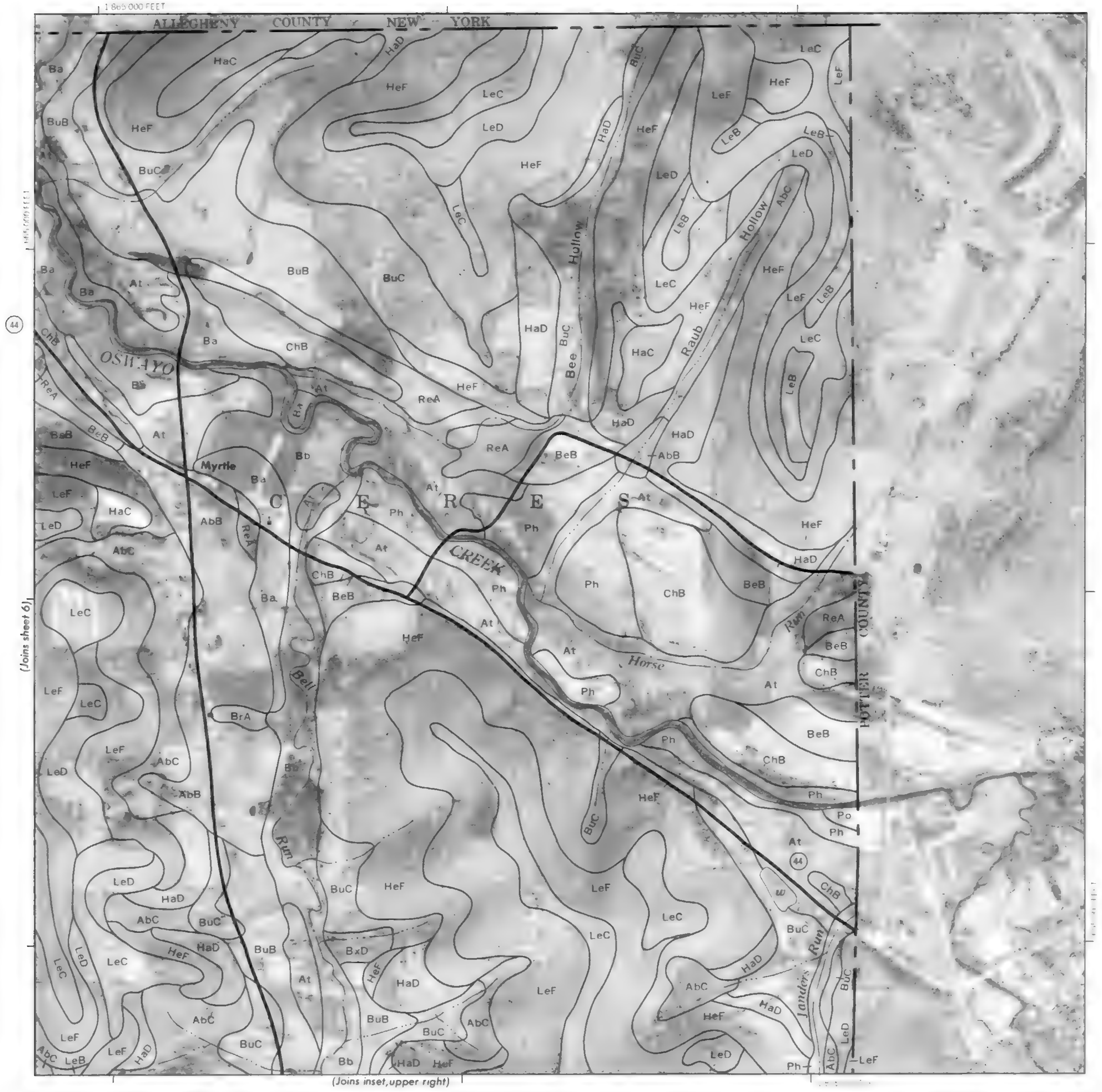
SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 2


CATTARAUGUS COUNTY NEW YORK
F O S T E R
B R A D F O R D
BRADFORD
Gilbert Run
Hedgehog Hollow
Bennett Brook
Bolivar Run
Latham Creek
Tunungwant Creek
Brown Valley
Gates Hollow
Reservoir No. 2
Reservoir No. 4
West Branch
BALTIMORE AND OHIO
CONRAIL
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 9)
N
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
0.5

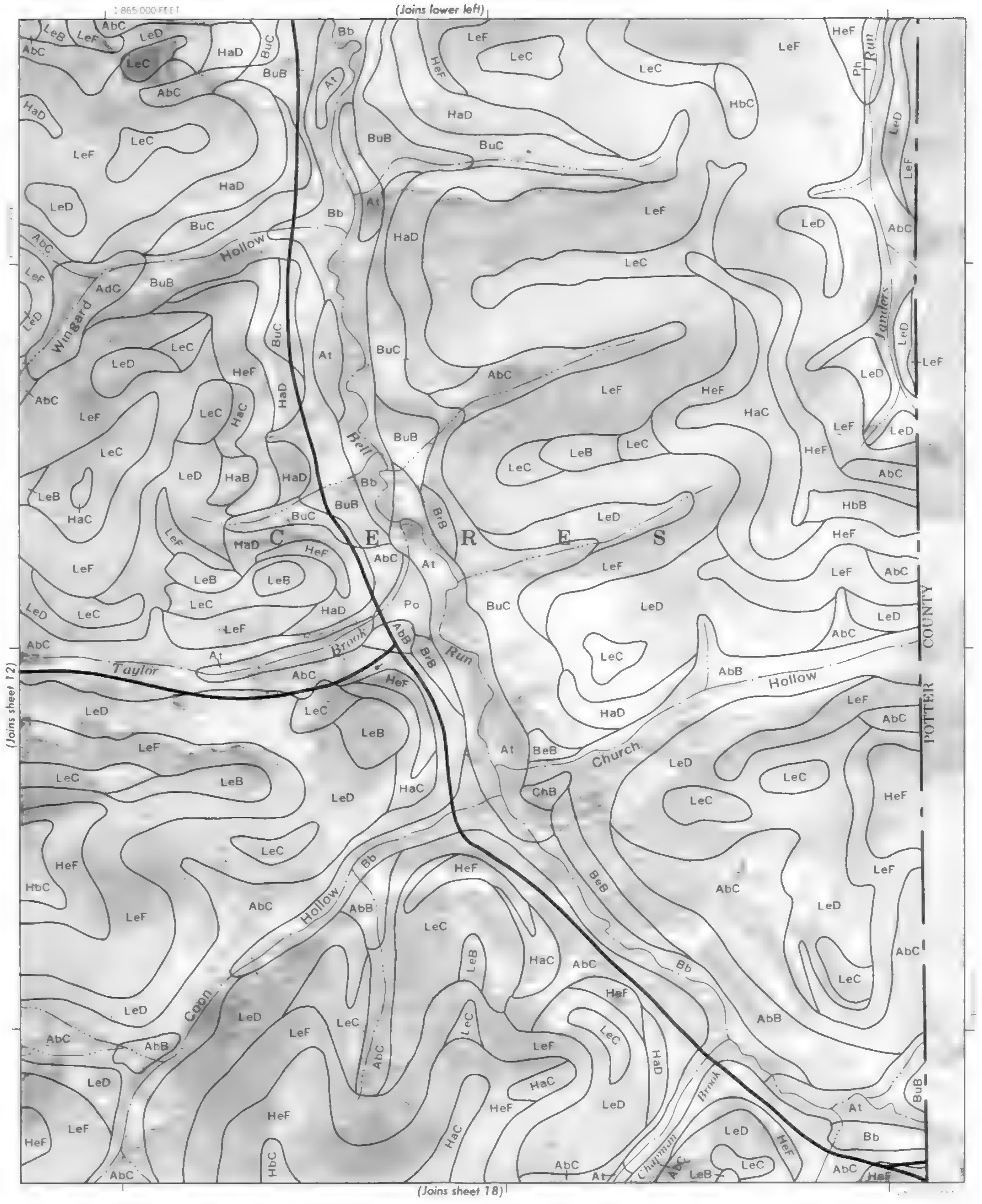
SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 4

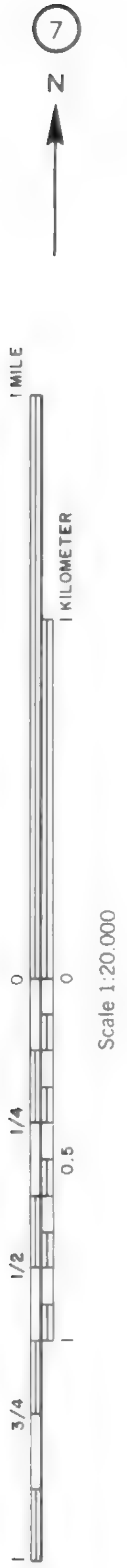
SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 5

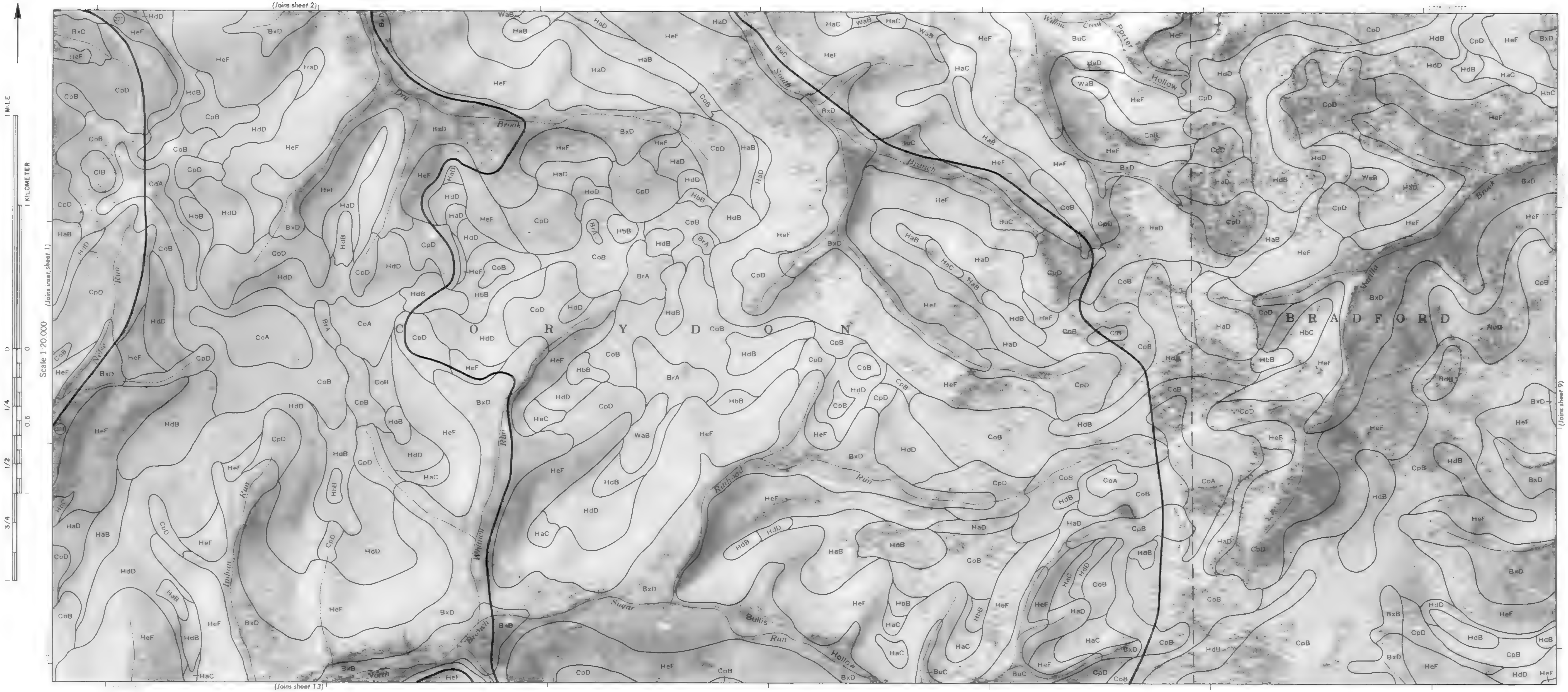

N
CATTARAUGUS COUNTY NEW YORK
ALLEGNY COUNTY NEW YORK
ALLEGHENY RIVER
OSWAYO CREEK
Dutton Hollow
Mix Hollow
McCred Run
Burden Brook
Champlin Hollow
Slippery Elm Hollow
George Hollow
Bullis Mills
CONRAIL
ELDRED
CERES
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 12)
Scale 1:20,000
1 MILE
1 KILOMETER
0
0.5
1/4
1/2
3/4
1

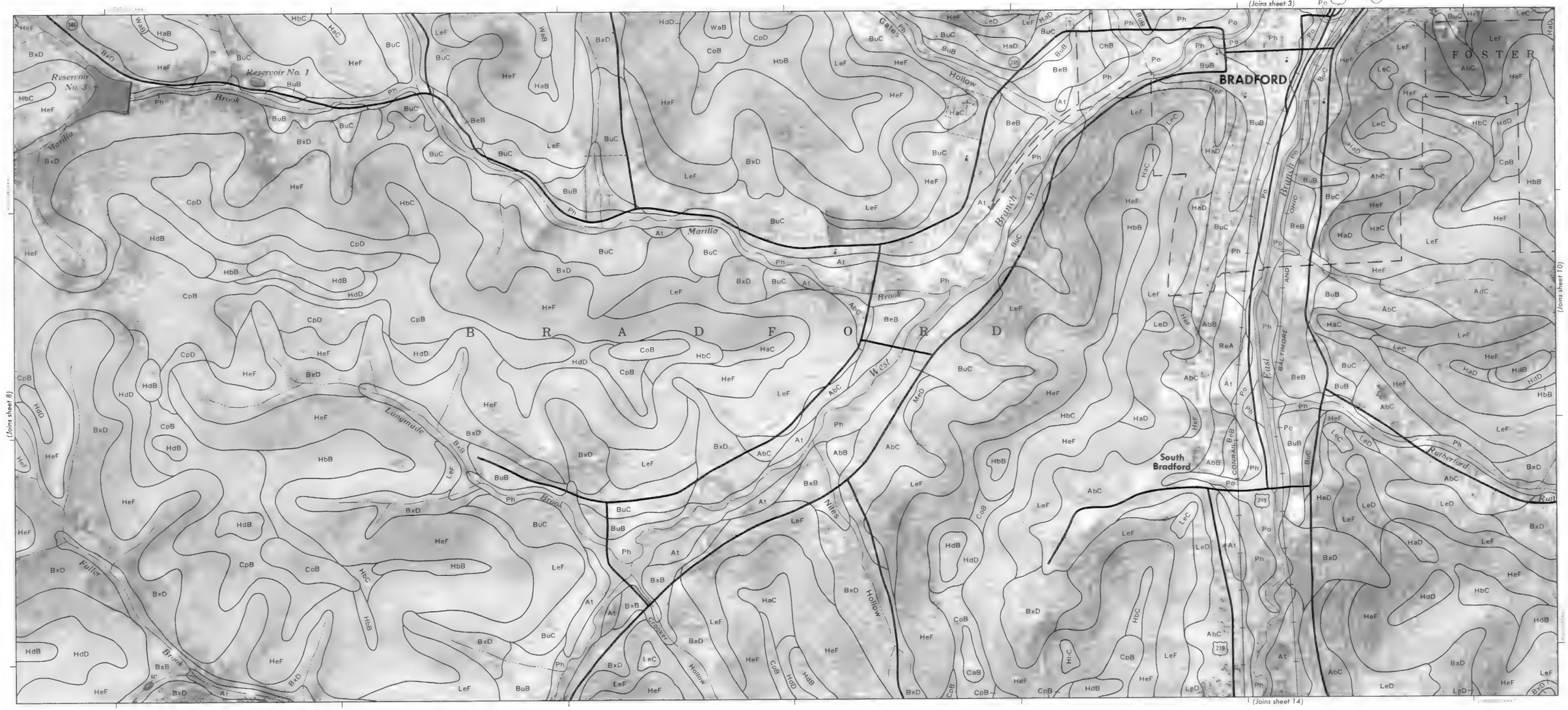

1 865 000 FEET
ALLEGHENY COUNTY NEW YORK
OSWAYO
CREEK
Myrtle
C E R E S
Hollow
Raub Hollow
Bee
Horse Run
Bell Run
Landers Run
POTTER COUNTY
(Joins sheet 6)
(Joins inset, upper right)
44

INSET

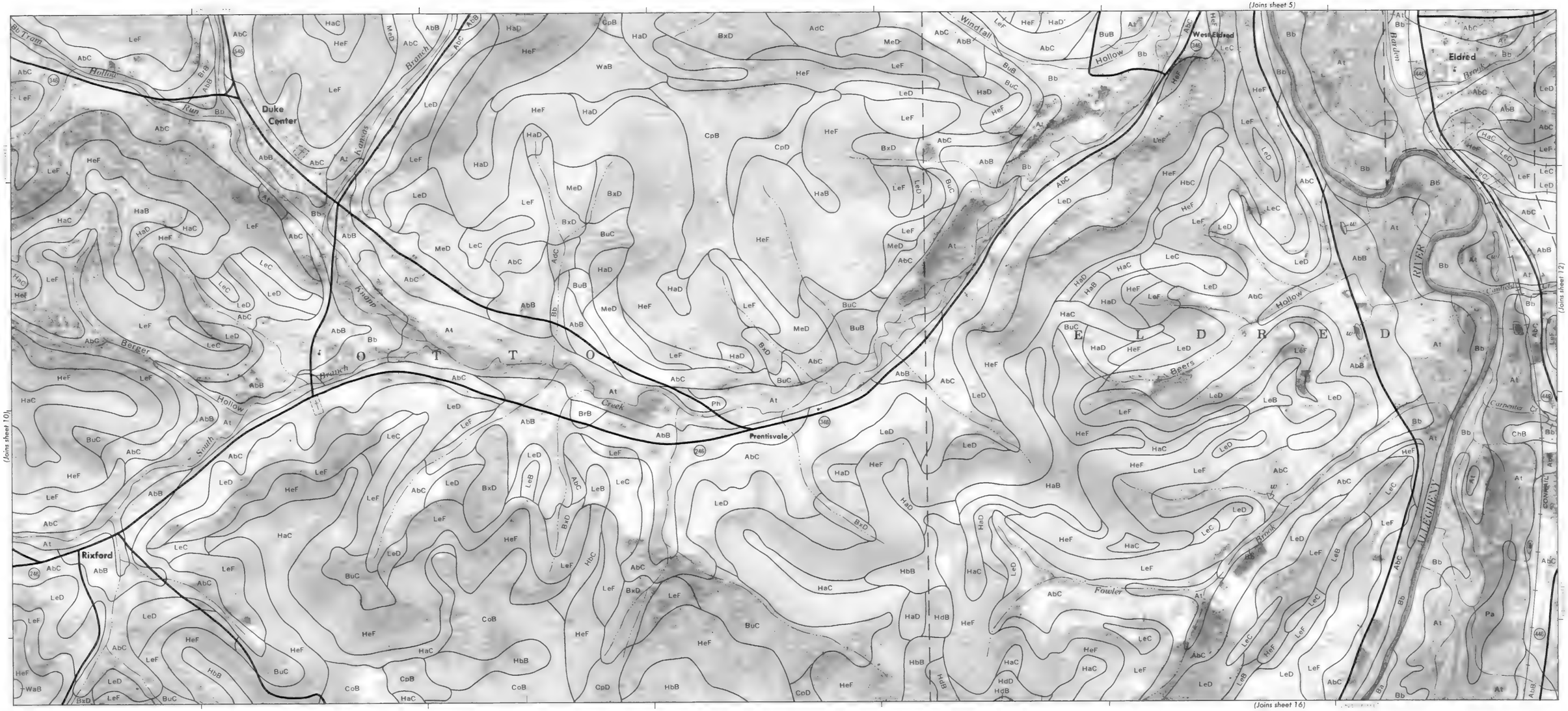

1 865 000 FEET
(Joins lower left)
Wingard Hollow
Bell Run
Taylor Brook
C E R E S
Hollow
Church
Coon Hollow
Chapman Brook
Landers
POTTER COUNTY
(Joins sheet 12)
(Joins sheet 18)


7
N
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
0.5

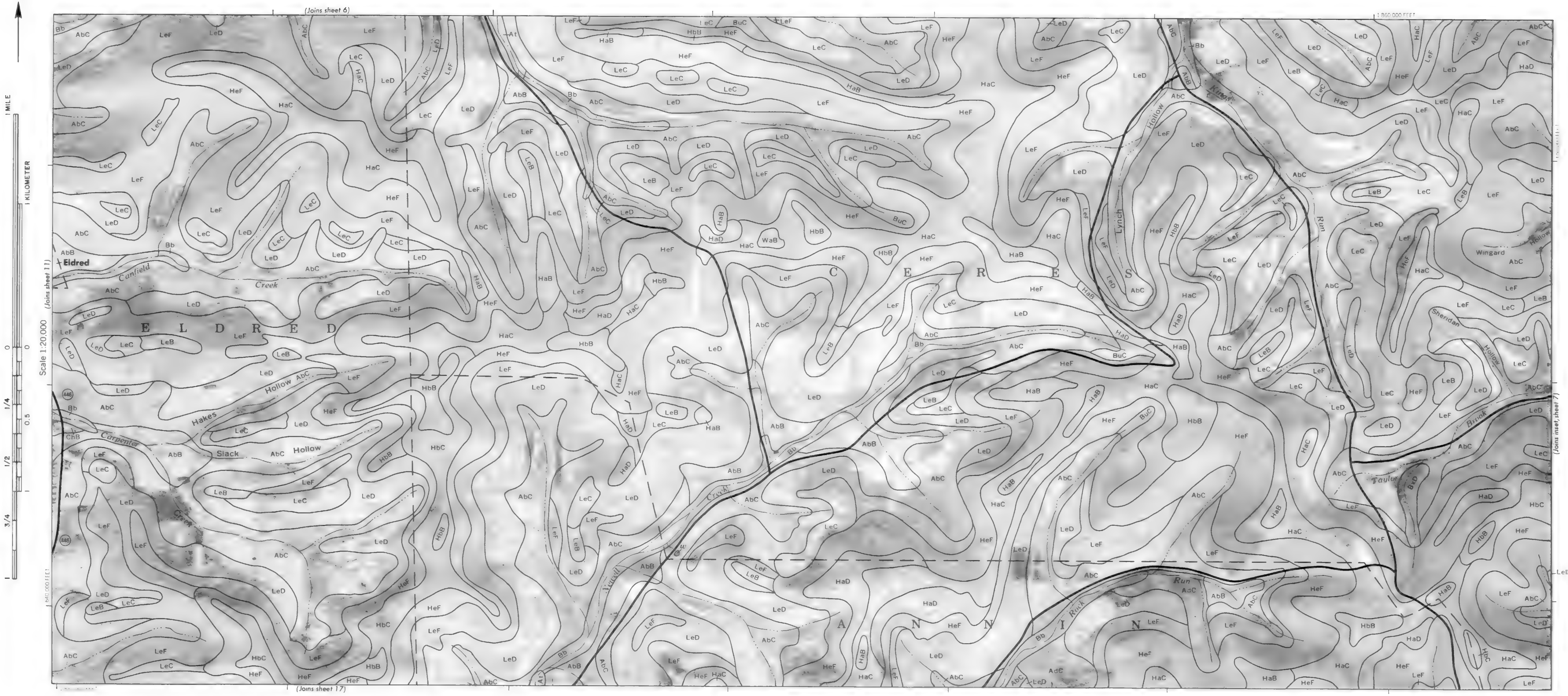

N
1 MILE
1 KILOMETER
Scale 1:20,000
0
1/4
0.5
1/2
3/4
1
(Joins sheet 2)
(Joins inset sheet 1)
(Joins sheet 9)
(Joins sheet 13)
C O R Y D O N
B R A D F O R D
Dry Brook
South Branch
Willow Creek
Porter Hollow
Railroad Run
Whitney Run
Indian Run
Sugar Run
Bullis Hollow
Run
Branch
North
Brook
Mallia


BRADFORD
FOSTER
South Bradford
Reservoir No. 3
Reservoir No. 1
Marilla Brook
Longmade Brook
Fuller Brook
Crooker Hollow
Niles Hollow
Gates Hollow
West Branch Tunungwant Creek
Rutherford Run
BUFFALO, ROCHESTER AND PITTSBURGH
BALTIMORE AND OHIO
CONRAIL
(Joins sheet 3)
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 14)
N
Scale 1:20,000
MILE
KILOMETER


10
N
BRADFORD
(Joins sheet 4)
(Joins sheet 9)
(Joins sheet 11)
(Joins sheet 15)
Scale 1:20,000
1 MILE
1 KILOMETER
F O S T E R
O T T O
B R A D F O R D
Sawyer City
Dallas City
Corwins Corners
Summit
Rixford
Lafferty Run
Kendall
Totten Hollow
Buchanan Hollow
Chamberlain Hollow
Creek
Garlock Hollow
Pratt Hollow
Rutherford Run
Baker Run
South Branch Knapp Creek
46
246
646


(Joins sheet 5)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 16)
Bb Tram
Hollow
Run
Duke Center
Branch
Agnes
Knapp
Berger
Hollow
South
Branch
Rixford
Windfall
Hollow
West Eldred
Eldred
Barton
Brook
Hollow
ELDRED
Beers
Creek
Prentisvale
Fowler
Brook
Carpenter Cr
ALLEGHENY RIVER
Scale 1:20,000
1 MILE
1 KILOMETER
N

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 12

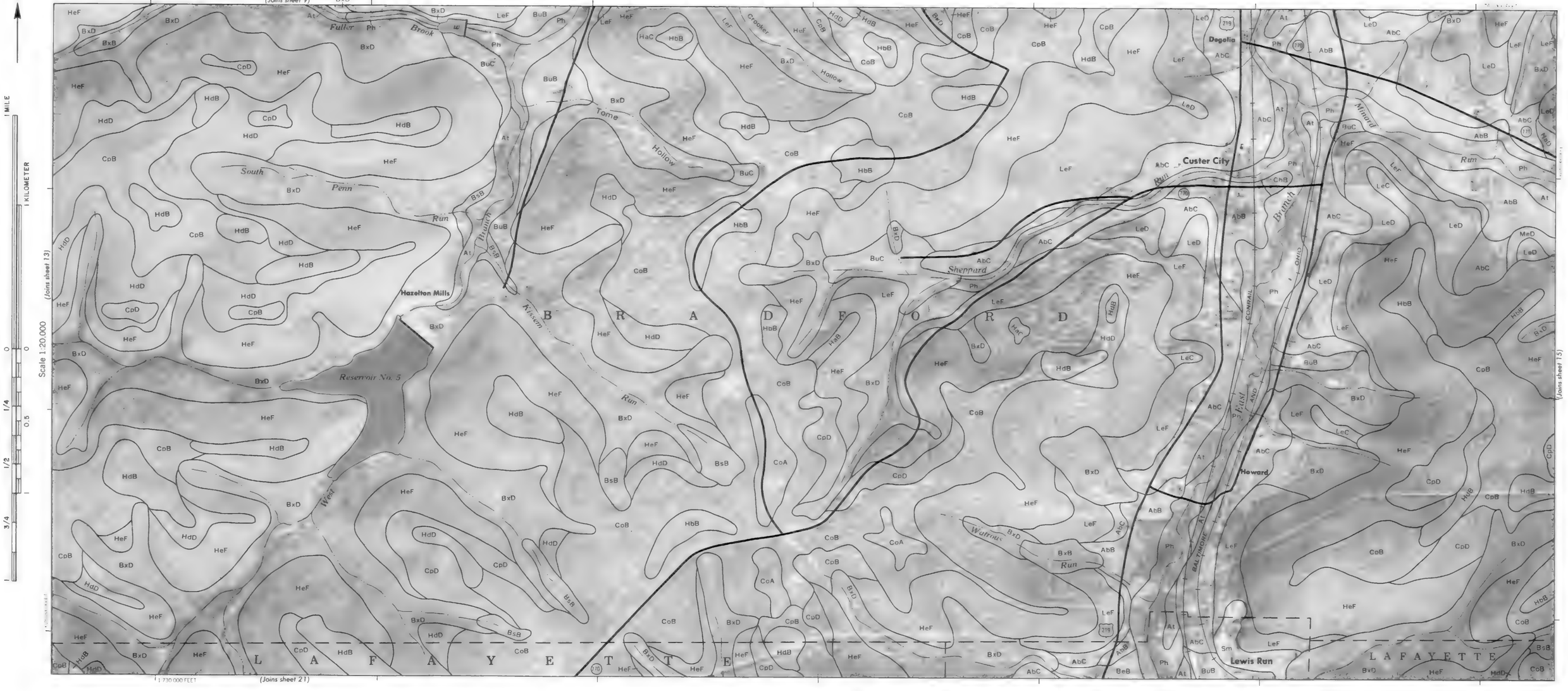


13

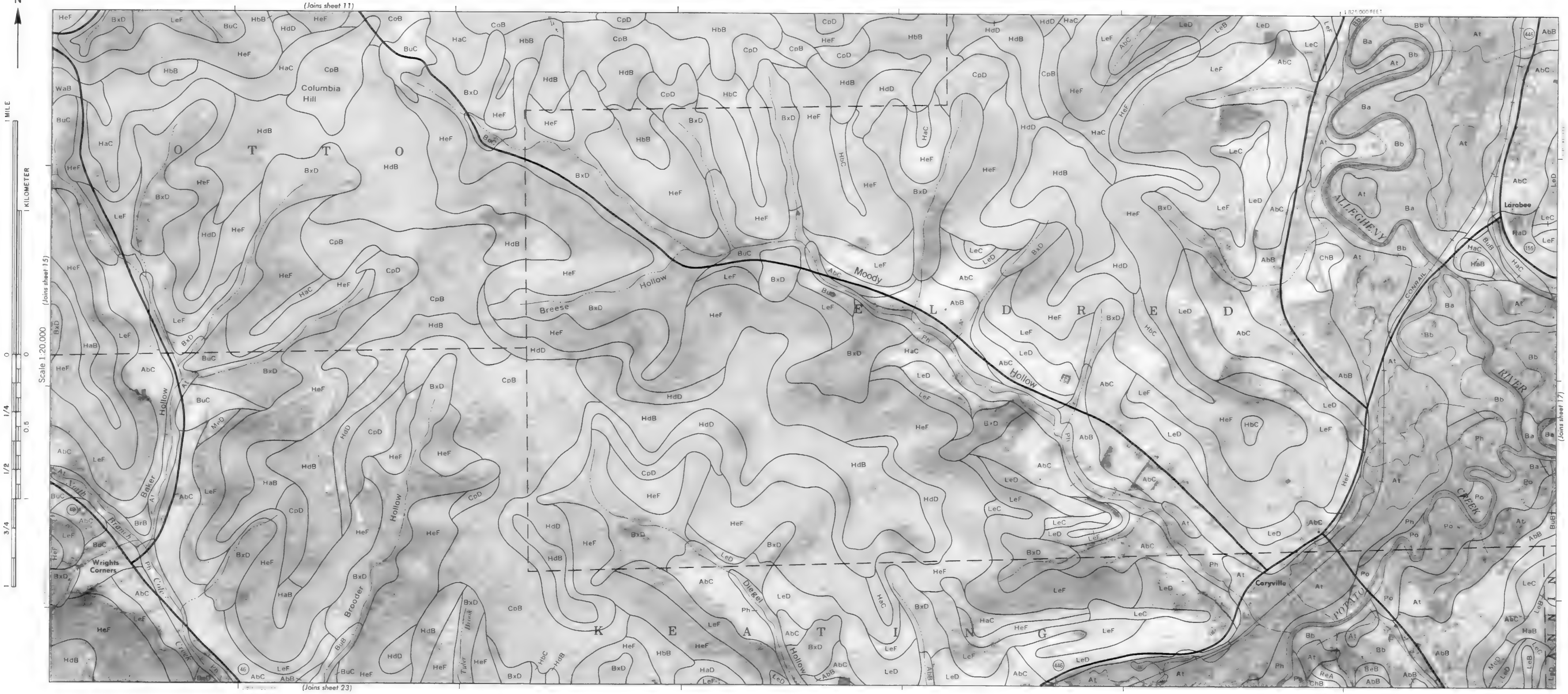
N

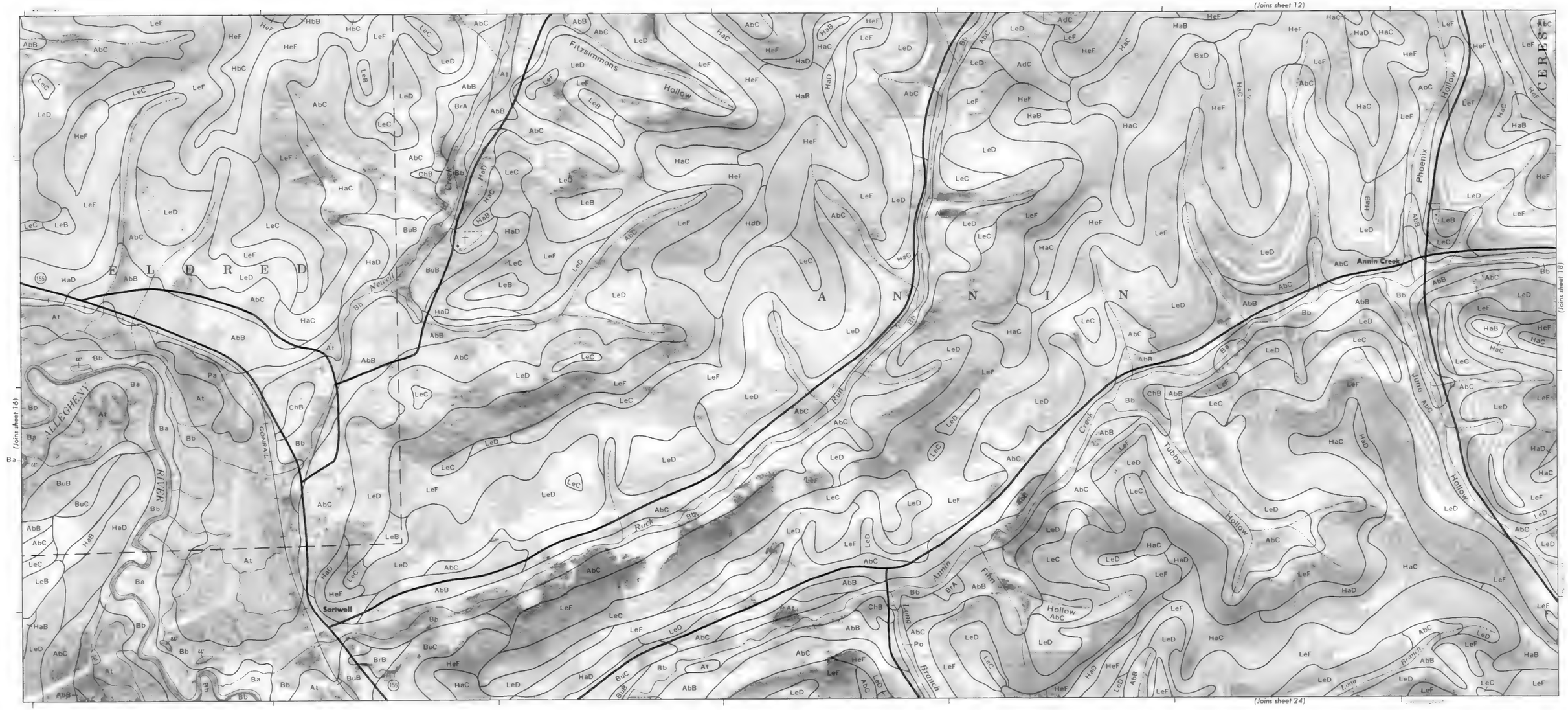
1 MILE
1 KILOMETER
0 0
1/4 0.5
1/2 1
3/4 1

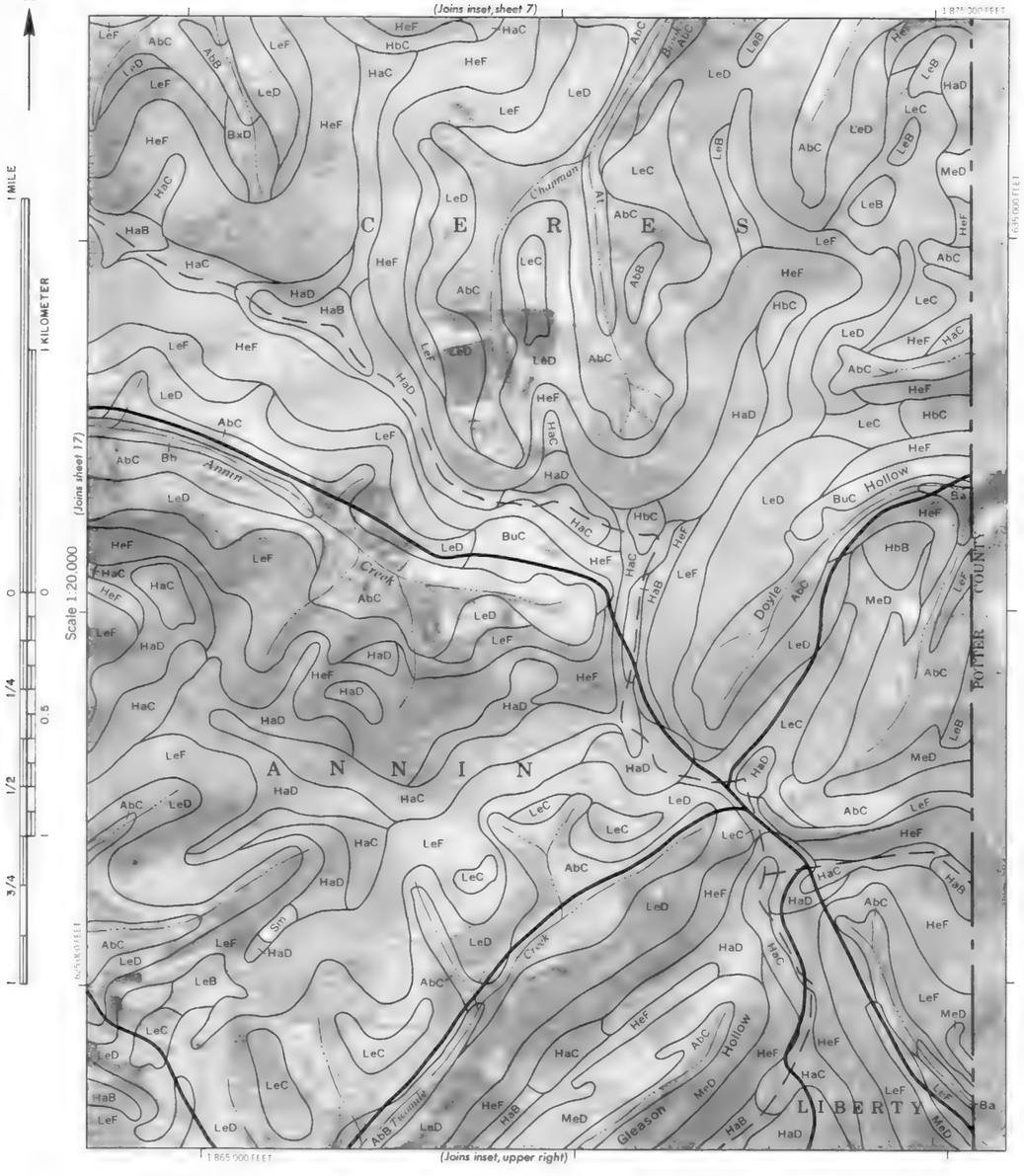
Scale 1:20,000

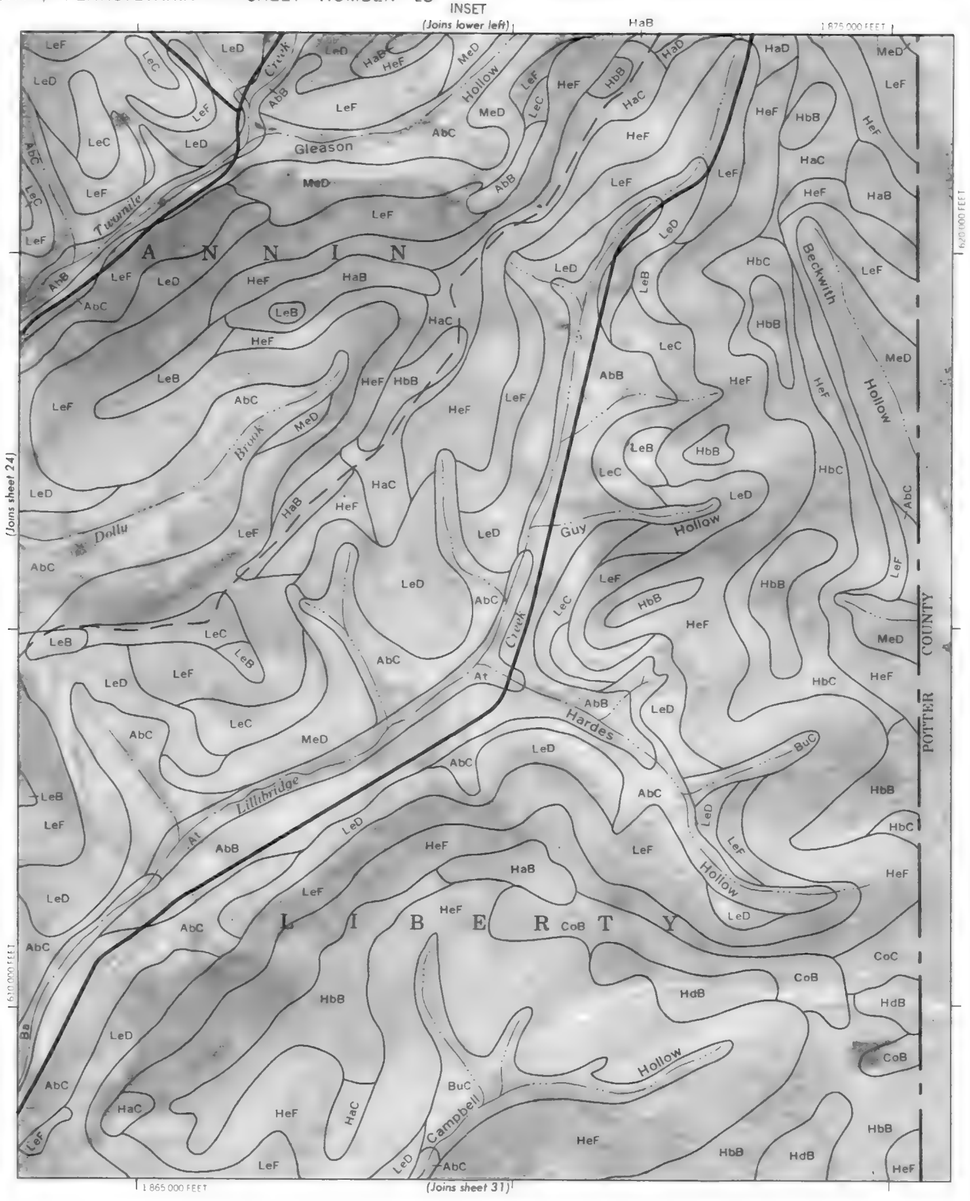

14
N
1 MILE
1 KILOMETER
Scale 1:20,000
1 730 000 FEET
(Joins sheet 9)
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 21)
Fuller Brook
Trome Hollow
Crooker Hollow
South Penn Run
Branch
Kissem Run
Reservoir No. 5
West Run
Sheppard Run
Wolfrous Run
Mimard Run
Custer City
Degolia
Hazelton Mills
Howard
Lewis Run
CONRAIL
BALTIMORE AND OHIO
BRADFORD
LAFAYETTE
LAFAYETTE


(Joins sheet 10)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 22)
B R A D F O R D
F O S T E R
O T T O
K E A T I N G
L A F A Y E T T E
Middletown
Coleville
Row
Aiken
Bordell
Tibbitts
Hollow
Minard
Foster
Run
Kendall
Creek
Knapp
Branch
South
North
Cole
N
1 MILE
1 KILOMETER
Scale 1:20 000

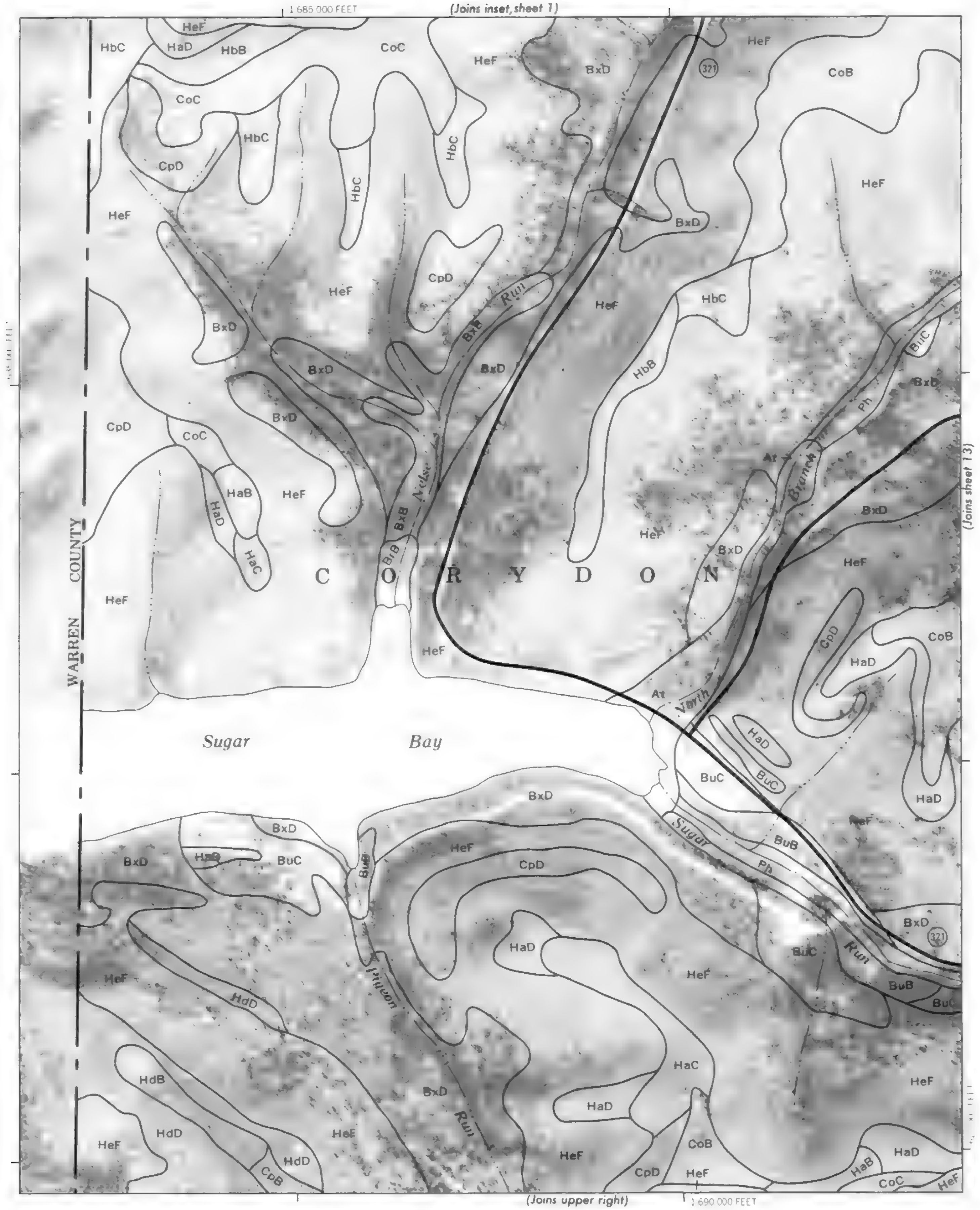

N
(Joins sheet 11)
(Joins sheet 15)
(Joins sheet 17)
(Joins sheet 23)
1 MILE
1 KILOMETER
Scale 1:20 000
Columbia Hill
O T T O
E L D R E D
K E A T I N G
Breese Hollow
Moody Hollow
Baker Hollow
Brooder Hollow
Diegel Hollow
North Branch
Cole Creek
Tyler Brook
ALLEGHENY RIVER
POTATO CREEK
CONRAIL
Wrights Corners
Larabee
Coryville


(Joins sheet 12)
(Joins sheet 16)
(Joins sheet 18)
(Joins sheet 24)
ELDRED
ANNIN
CERES
Fitzsimmons Hollow
Neiswell Creek
Annin Creek
Phoenix Hollow
Ruck Run
Tubbs Creek
June Hollow
Finn Hollow
Long Branch
ALLEGHENY RIVER
CONRAIL
Sartwell
1 MILE
1 KILOMETER
Scale 1:20,000


18
N
1 MILE
1 KILOMETER
Scale 1:20,000
(Joins inset, sheet 7)
(Joins sheet 17)
(Joins inset, upper right)
1 875 000 FEET
1 865 000 FEET
CERES
ANNIN
LIBERTY
POTTER COUNTY
Annin
Creek
Doyle
Hollow
Gleason
Brunk
Chapman


INSET
(Joins lower left)
(Joins sheet 24)
(Joins sheet 31)
1 875 000 FEET
1 865 000 FEET
ANNIN
LIBERTY
POTTER COUNTY
Gleason
Tuunnie
Brunk
Dollu
Guy
Hollow
Beckwith
Creek
Lillibridge
Hardes
Campbell

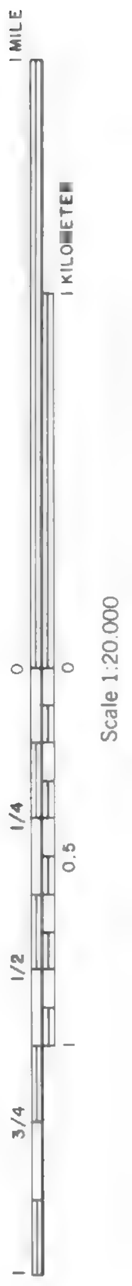
INSET

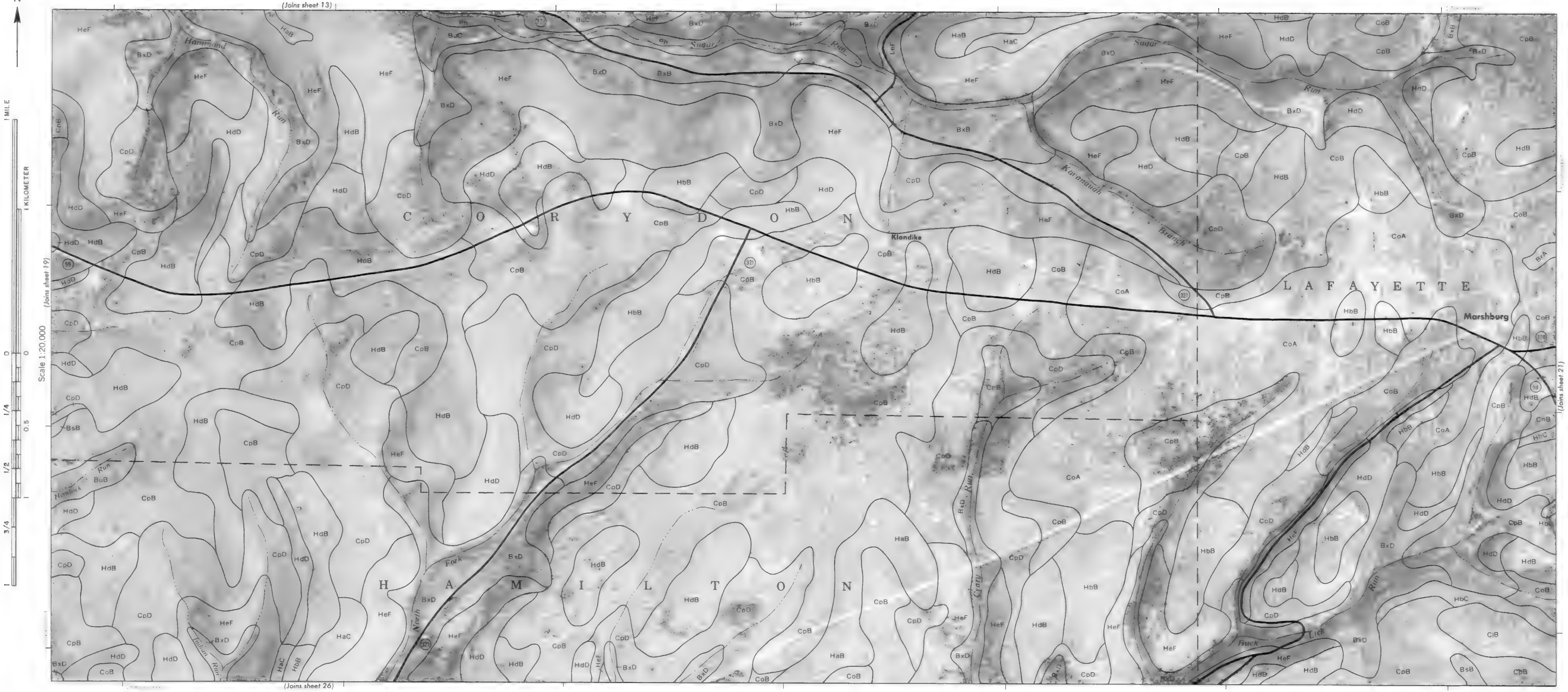

(Joins inset, sheet 1)
1 685 000 FEET
WARREN COUNTY
CORYDON
Sugar Bay
North Branch
Sugar Run
Pigeon Run
Nelse Run
321
(Joins sheet 13)
(Joins upper right)
1 690 000 FEET

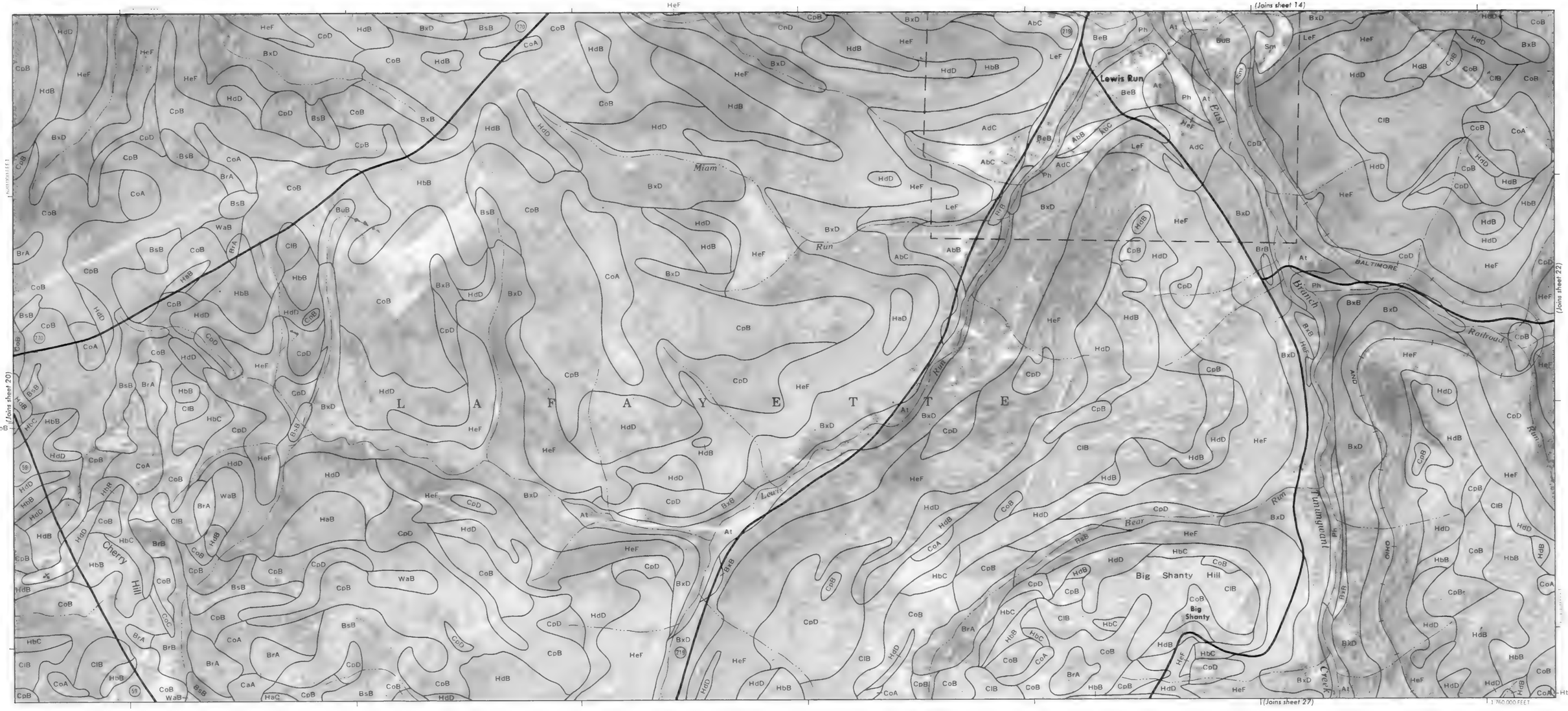

1 680 000 FEET
(Joins inset, lower left)
Pigeon Run
CORYDON
HAMILTON
WARREN COUNTY
Morrison Run
Hemlock Run
59
(Joins sheet 20)
(Joins sheet 25)
1 690 000 FEET

19

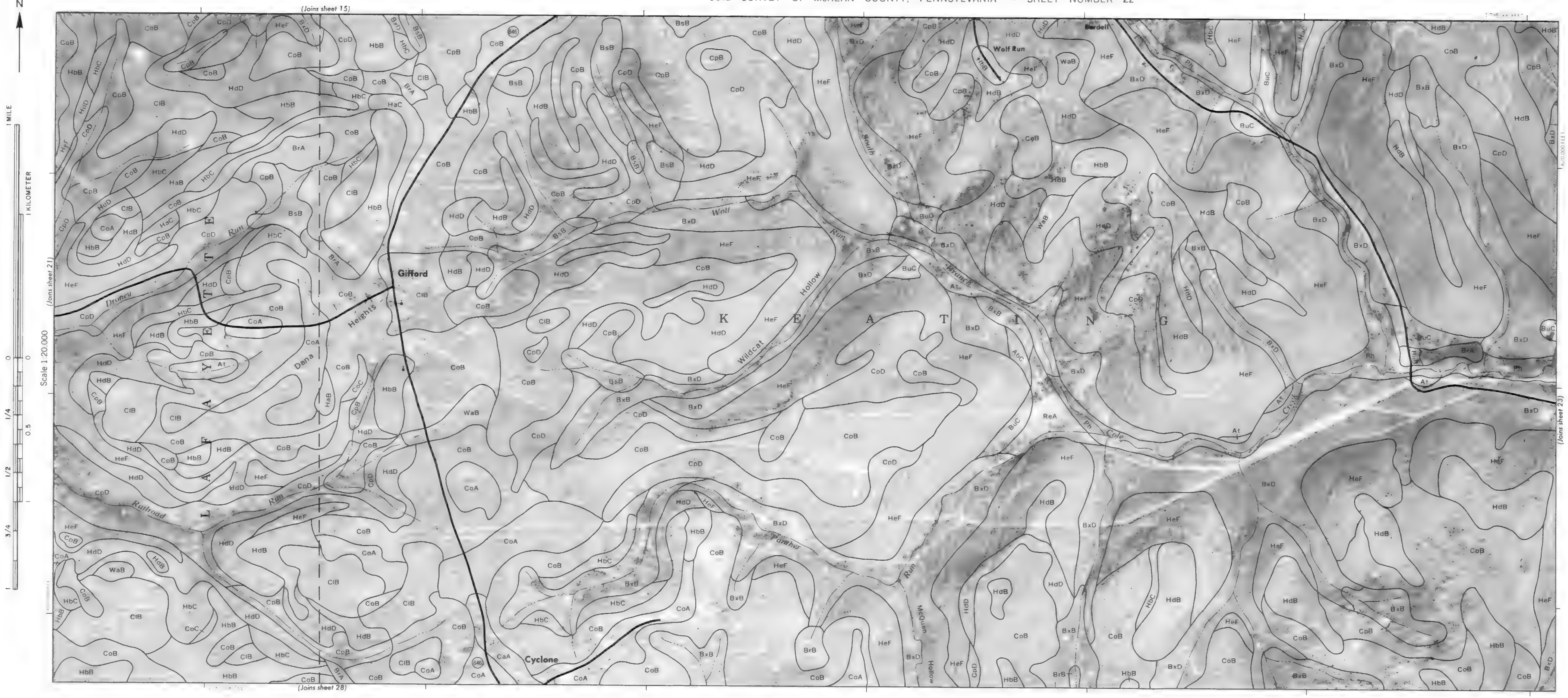
N


1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0
0.5
Scale 1:20 000

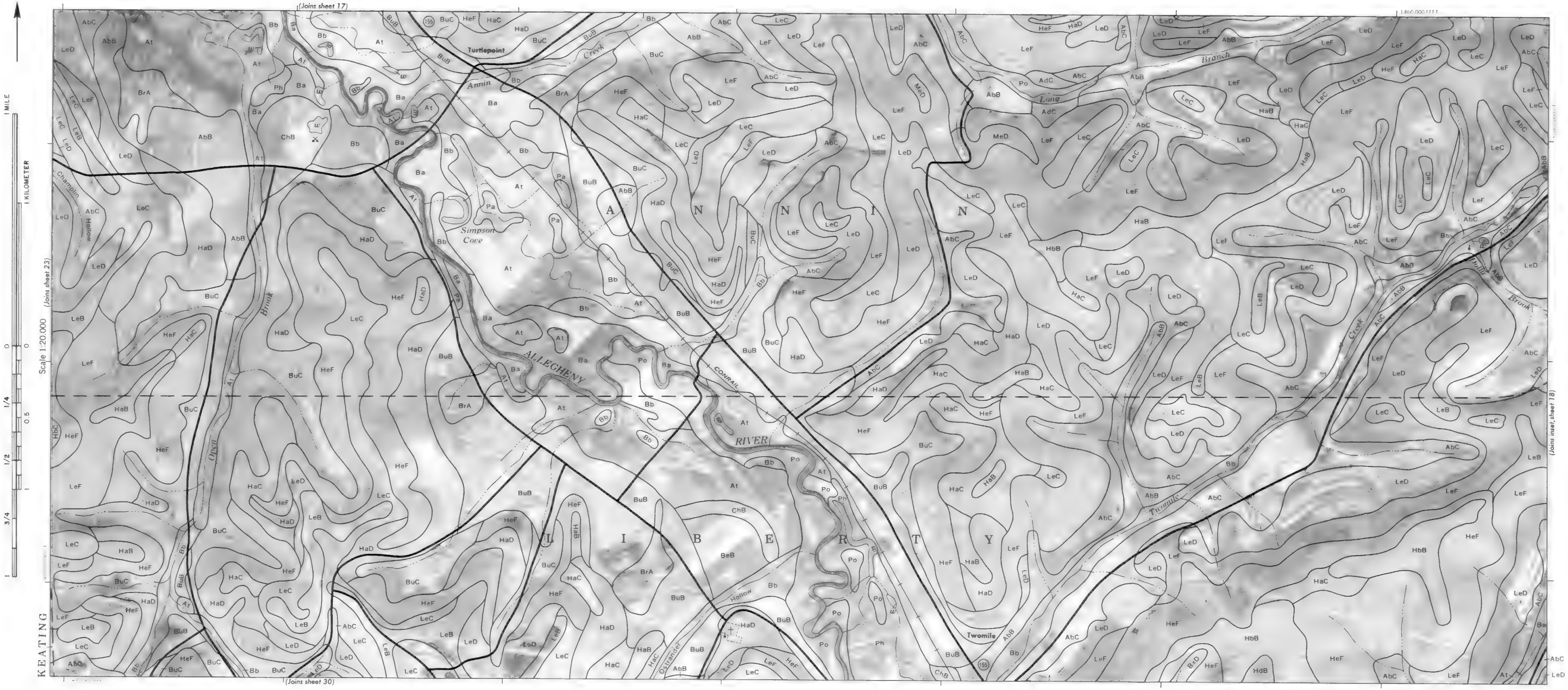

20
N
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
1
0
0.5
1
(Joins sheet 13)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 26)
C O R Y D O N
H A M I L T O N
L A F A Y E T T E
Klondike
Marshburg
Hammond Run
Sugar Run
Kavanaugh Branch
Hemlock Run
North Fork
Indian Run
Clary Run
Buck Lick Run
Lost
59
321


(Joins sheet 14)
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 27)
L A F A Y E T T E
Lewis Run
Miam Run
Lewis Run
Bear Run
Tunungwant Creek
Big Shanty Hill
Big Shanty
Cherry Hill
BALTIMORE AND OHIO Railroad
Branch
East
Run
Creek
N
1 MILE
1 KILOMETER
Scale 1:20,000
1 760,000 FEET

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 22

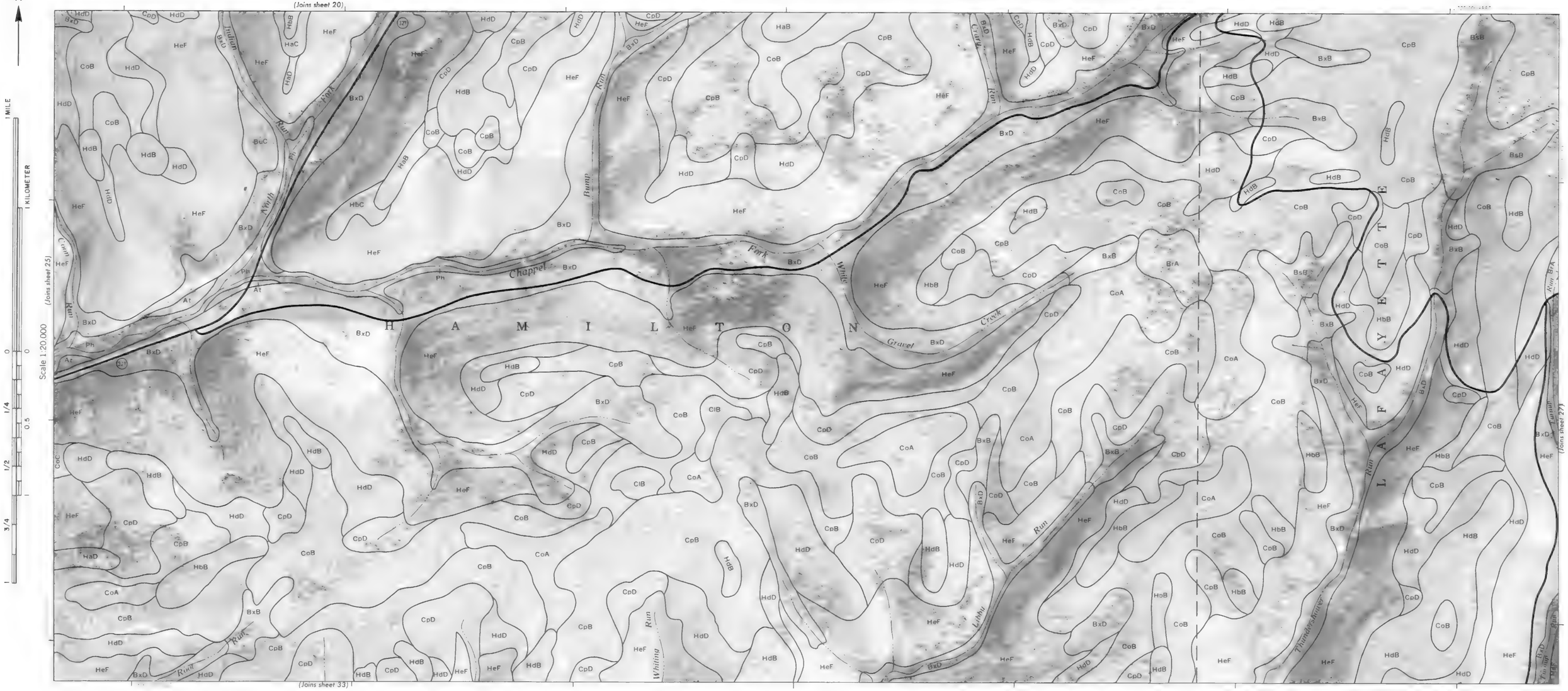


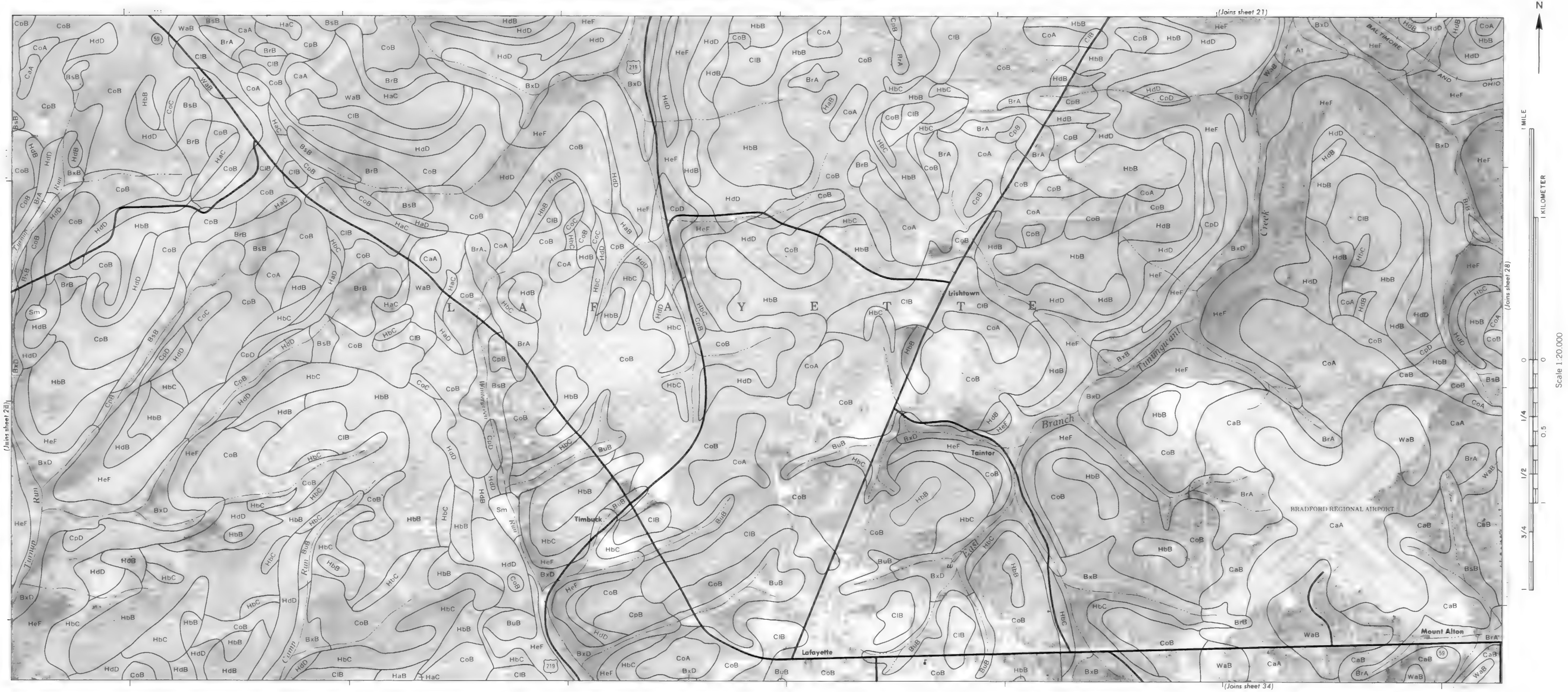
SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 23


N
(Joins sheet 17)
(Joins sheet 23)
(Joins sheet 30)
(Joins inset, sheet 18)
Scale 1:20 000
1 MILE
1 KILOMETER
KEATING
ANNIN
LIBERTY
ALLEGHENY
RIVER
Turtlepoint
Twomile
Simpson Cove
Annin Creek
Long Branch
Twomile Creek
Champlin Hollow
Open Brook
Ostrander Hollow
CONRAIL
1 860 000 FEET

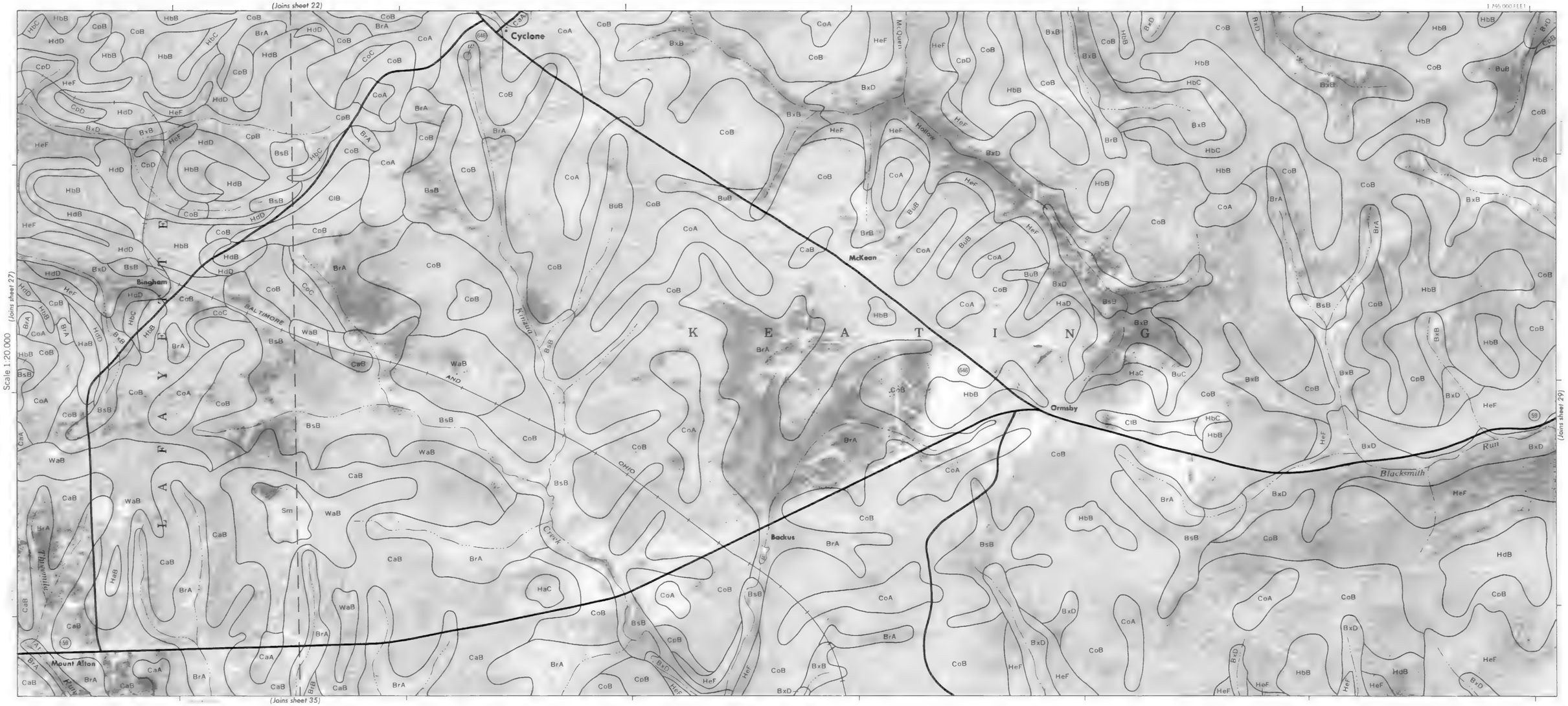

(Joins sheet 19)
ALLEGHENY
RESERVOIR
KINZUA
WARREN
COUNTY
H A M I L T O N
BAY
Chappel
Bay
Run
Dutchman
Hemlock
Bridges
Kettle
Tamarack
(Joins sheet 26)
(Joins sheet 32)
HeF
HdB
HdD
CpD
CpB
CoB
BxD
BuC
HaB
HaD
HbB
HbC
Ph
Af
CoC
321
N
1 MILE
1 KILOMETER
Scale 1:20,000

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 26

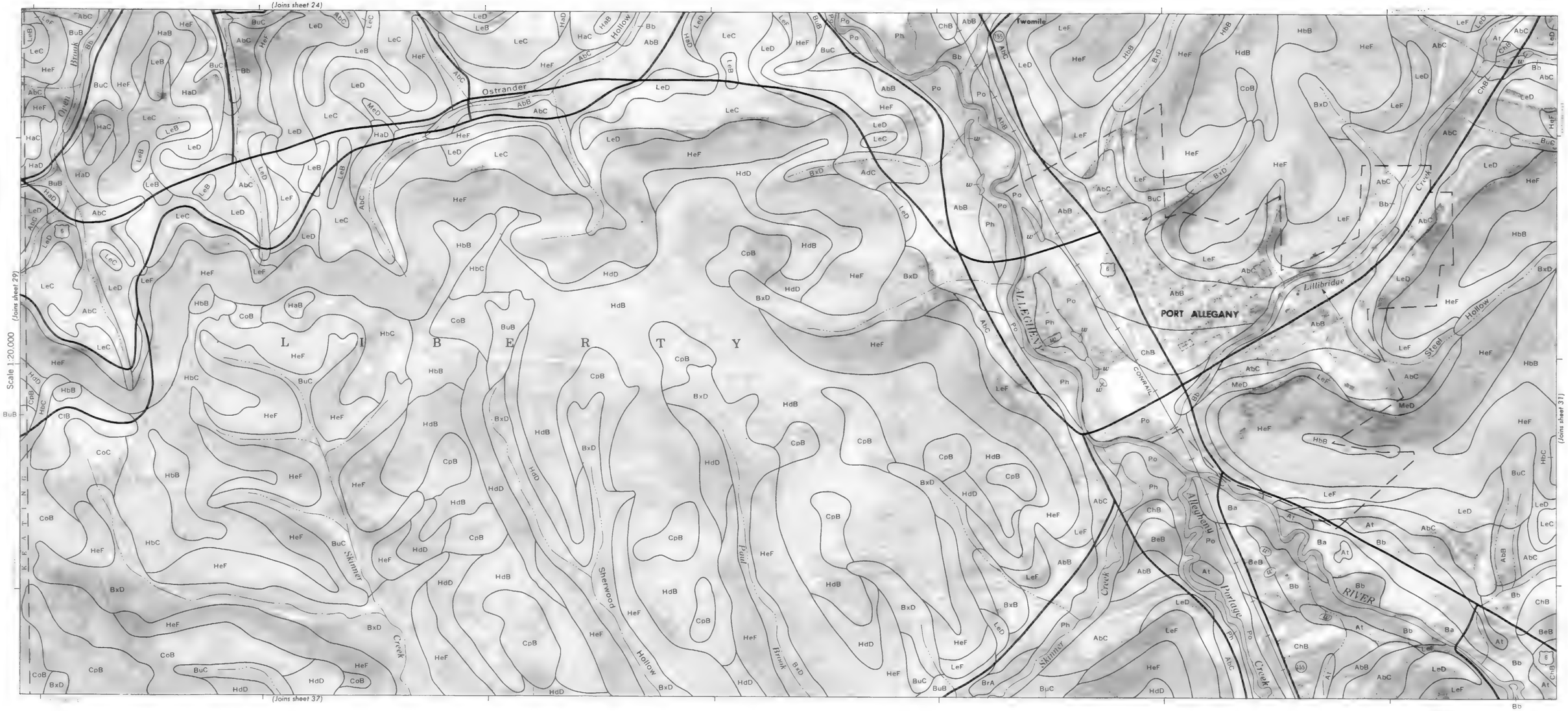


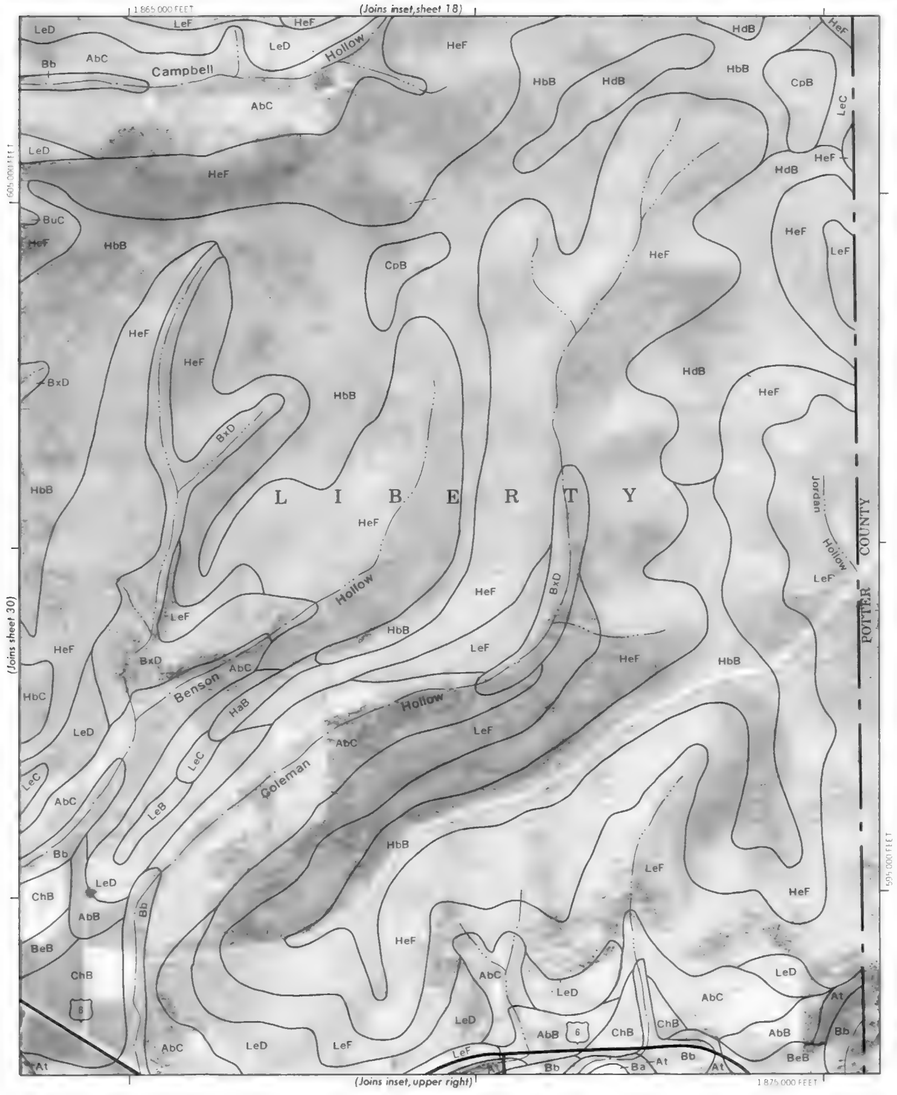

(Joins sheet 21)
(Joins sheet 28)
(Joins sheet 34)
N
L A F A Y E T T E
Irishtown
Taintor
Timbuck
Lafayette
Mount Alton
BRADFORD REGIONAL AIRPORT
Tunungwant
Creek
East Branch
BALTIMORE AND OHIO
219
59
1 MILE
1 KILOMETER
Scale 1:20 000

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 28

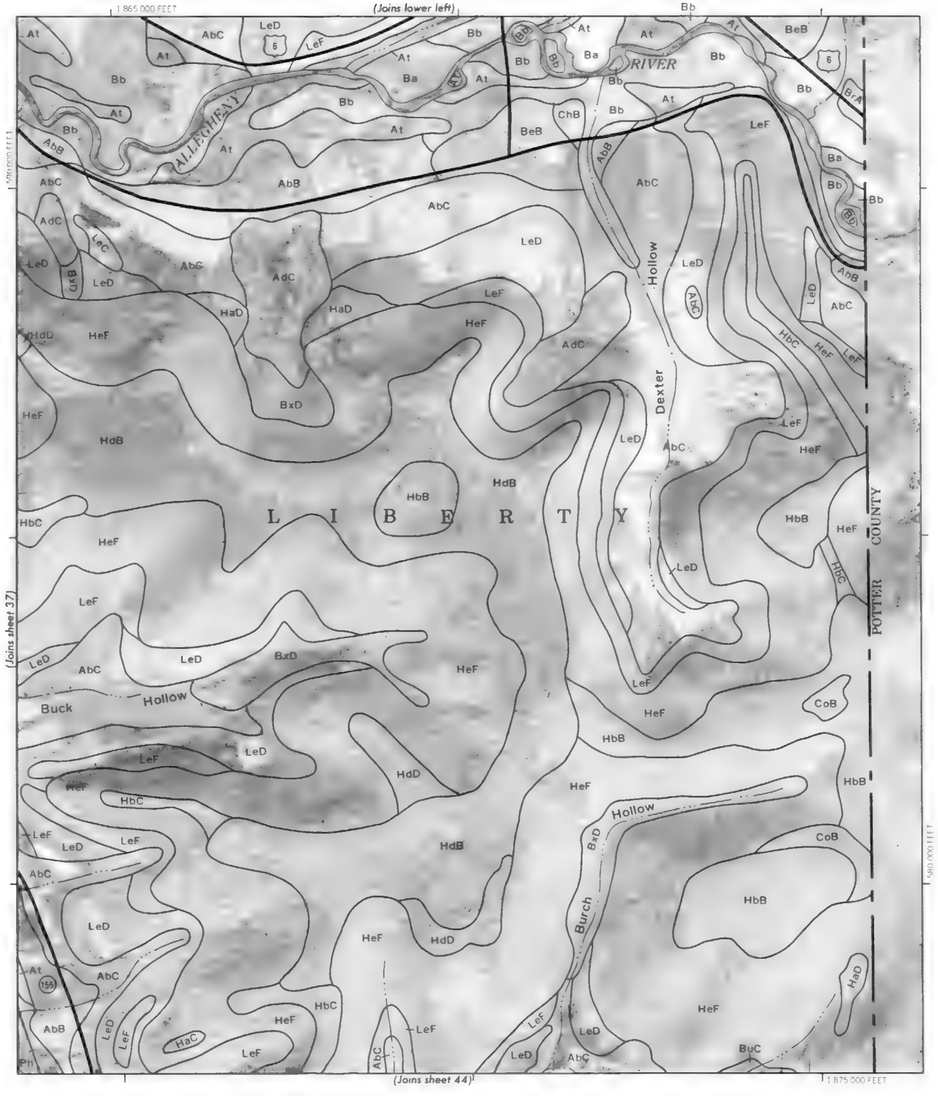



(Joins sheet 23)
(Joins sheet 28)
(Joins sheet 30)
(Joins sheet 36)
K E A T I N G
SMETHPORT
(county seat)
East Smethport
Devils Den
Stickles
Hollow
Bush Hill
Hacket
The Nipple
Gifford
Prospect Hill
Reilly
Pond Brook
Blacksmith Run
Marvin Creek
POTATO CREEK
N
1 MILE
1 KILOMETER
Scale 1:20,000


(30)
N
(Joins sheet 24)
Ostrander
Twomile
Lillibridge
PORT ALLEGANY
ALLEGHENY
CONRAIL
Steel Hollow
Allegheny
Portage
RIVER
Creek
Skinner
Sherwood
Hollow
Brook
Run
L I B E R T Y
1 MILE
1 KILOMETER
Scale 1:20,000
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 37)

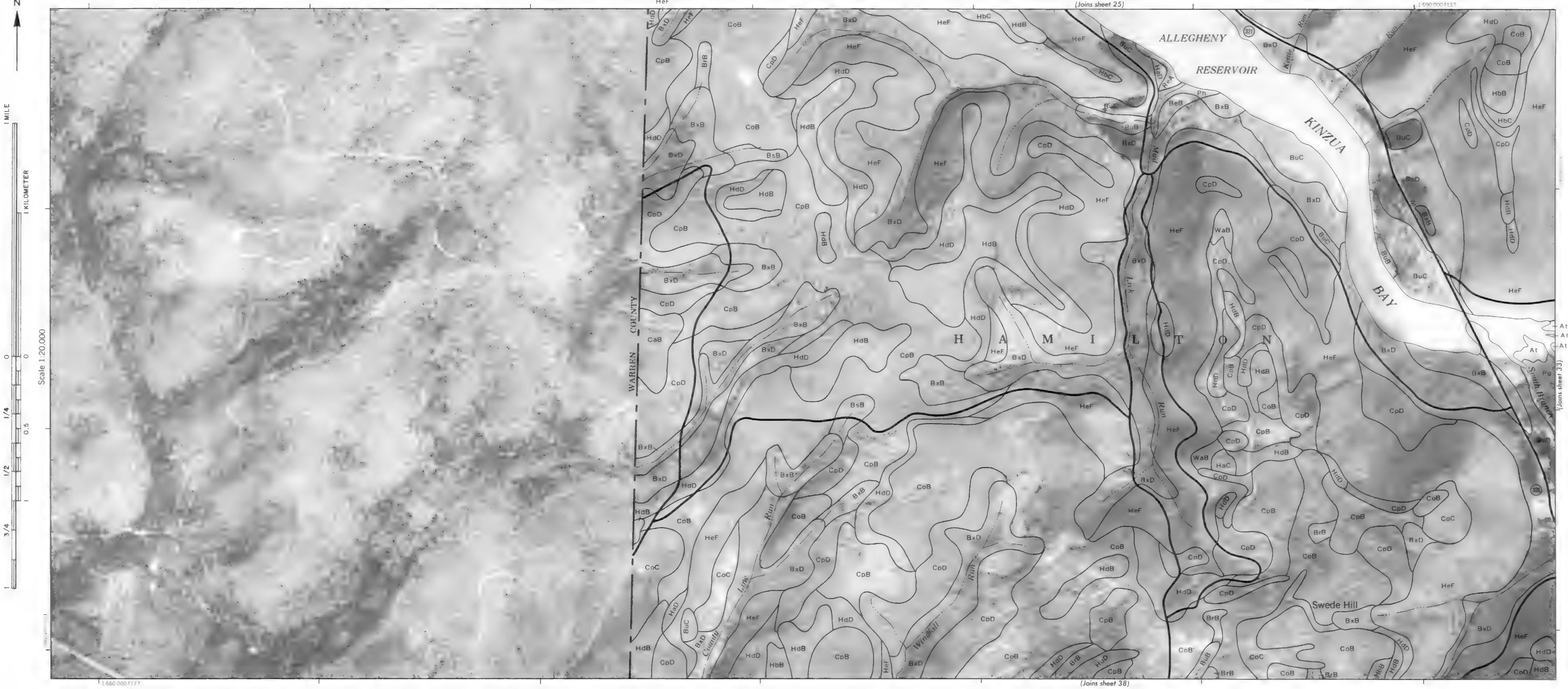

1 865 000 FEET
(Joins inset, sheet 18)
LIBERTY
POTTER COUNTY
Campbell
Hollow
Benson
Coleman
Jordan
(Joins sheet 30)
(Joins inset, upper right)
1 875 000 FEET
690 000 FEET

INSET

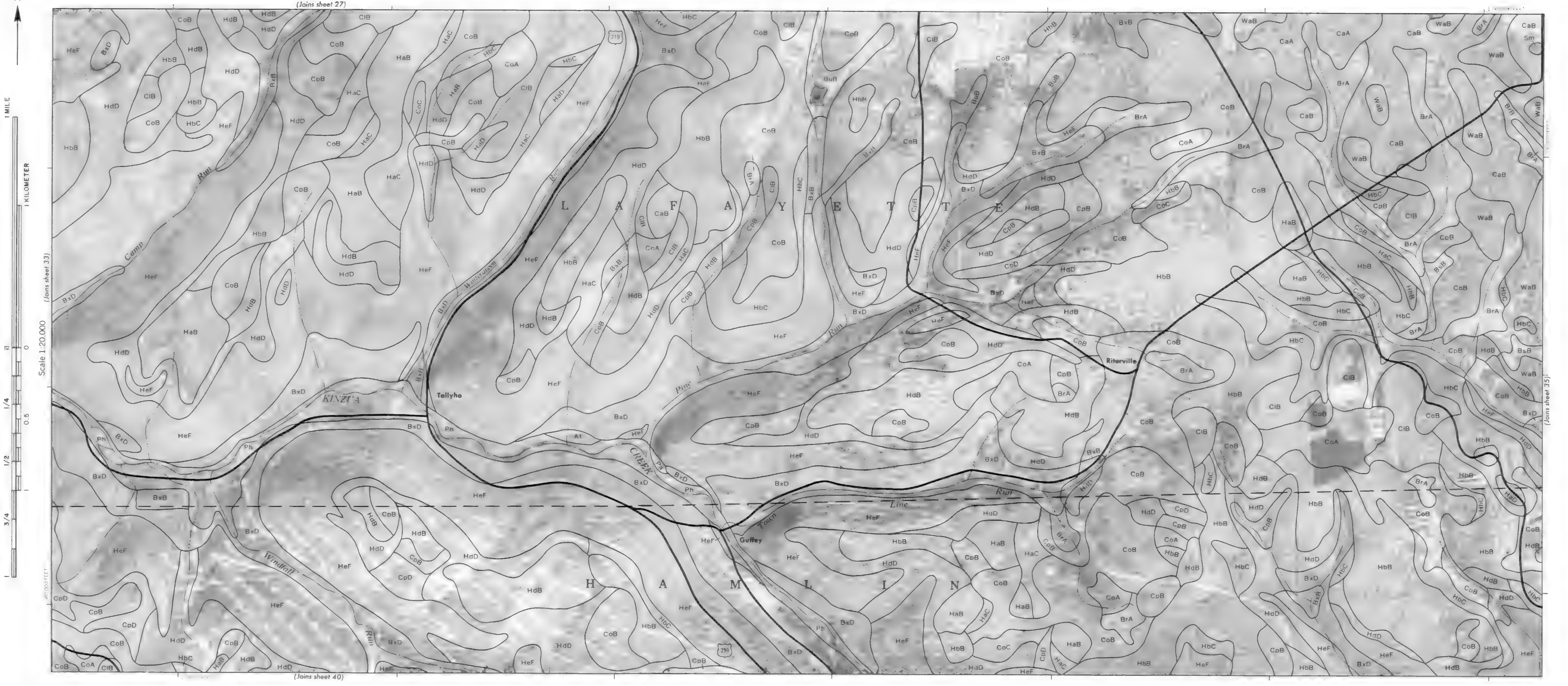

1 865 000 FEET
(Joins lower left)
ALLEGHENY RIVER
LIBERTY
POTTER COUNTY
Dexter
Buck
Hollow
Burch
(Joins sheet 37)
(Joins sheet 44)
1 875 000 FEET
690 000 FEET

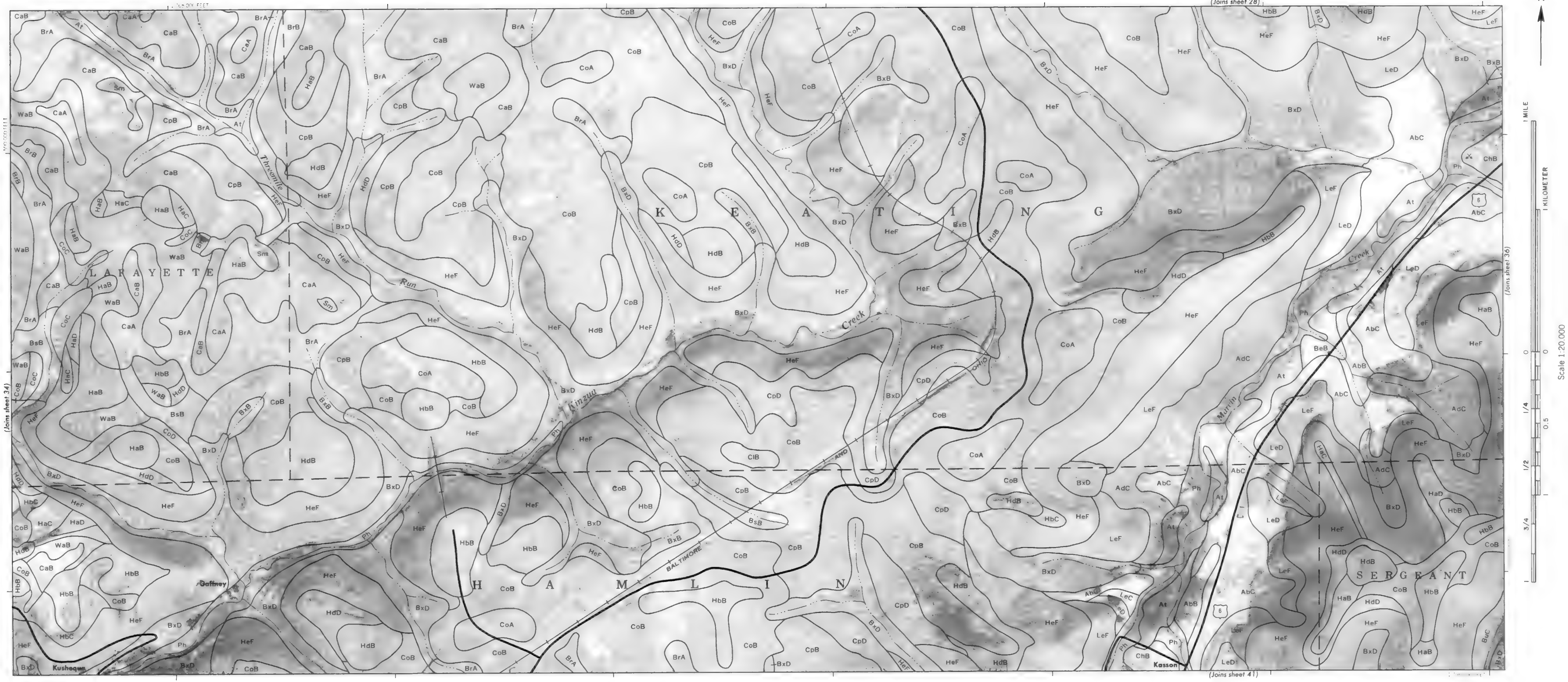

N
1 MILE
1 KILOMETER
Scale 1:20 000

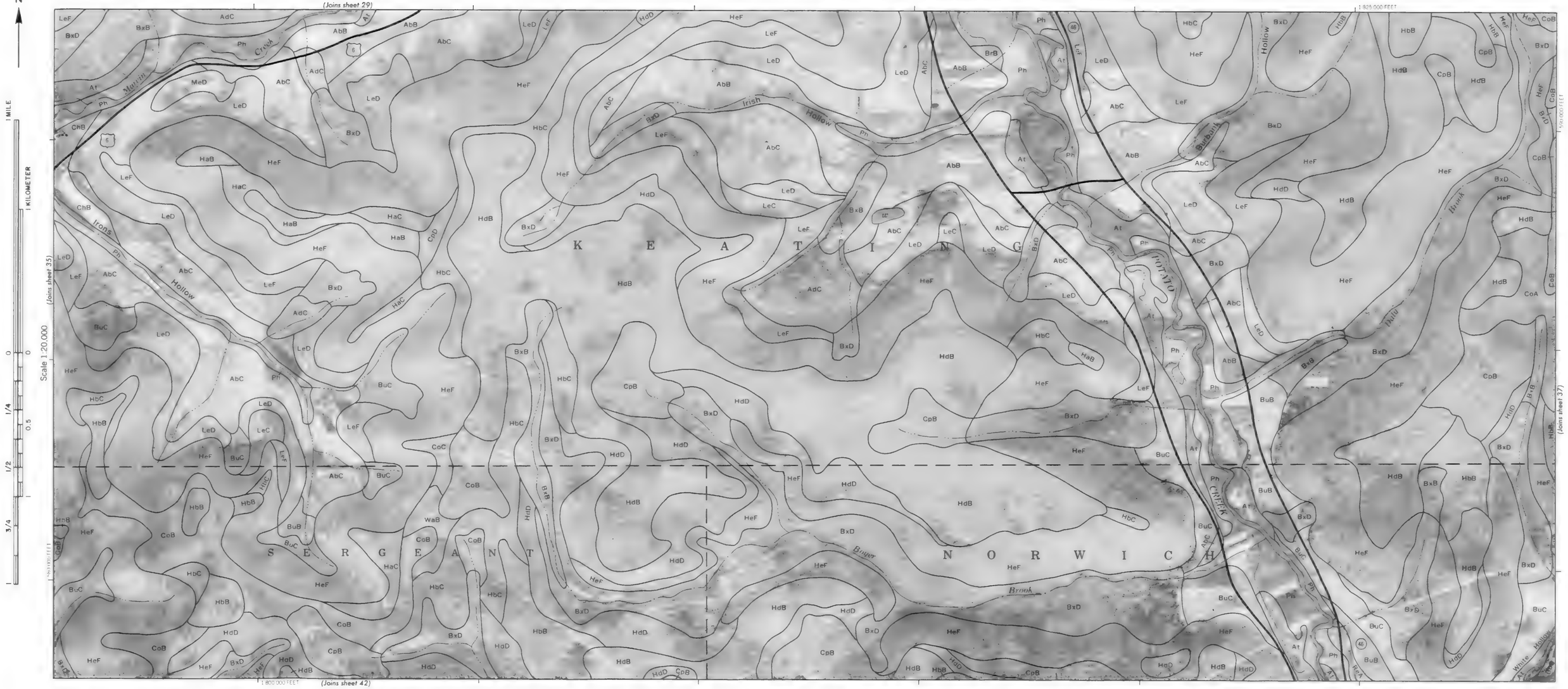
SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 32

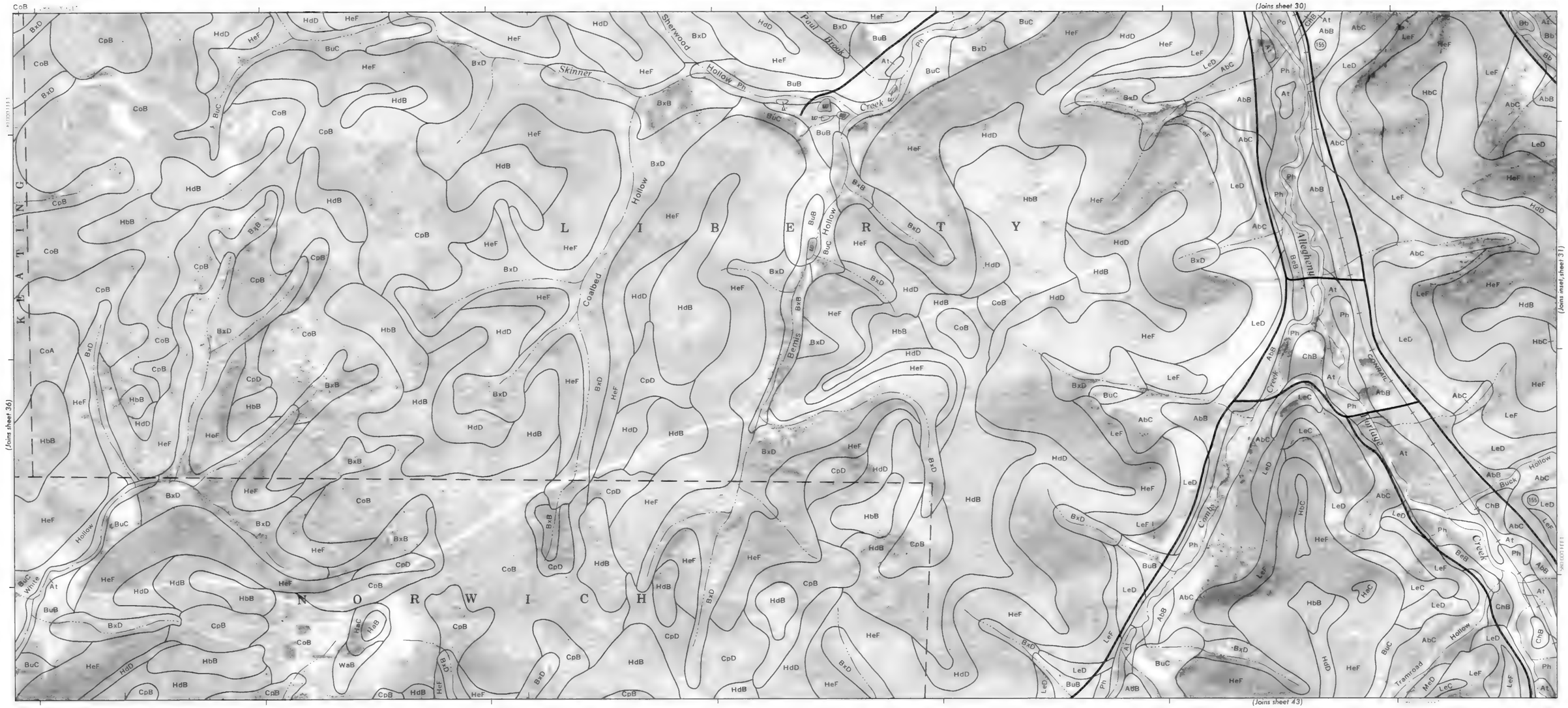



(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 39)
HAMILTON
KINZUA
CREEK
Markham Run
Whiting Run
Little Meade Run
Meade Run
Kinzua Creek
Thunderhouse Run
Comn Run
Westline
LAFAYETTE
WETMORE
HAMLIN
Blacksnake Run
Scale 1:20,000
1 MILE
1 KILOMETER
1 725 000 FEET


N
1 MILE
1 KILOMETER
Scale 1:20 000
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 40)
L A F A Y E T T E
H A M L I N
Tallyho
Riterville
Guffey
KINZUA
CREEK
Camp
Run
Pine
Run
Town
Line
Run
Windfall
Run
219


(Joins sheet 28)
(Joins sheet 34)
(Joins sheet 36)
(Joins sheet 41)
N
L A F A Y E T T E
K E A T I N G
H A M L I N
S E R G E A N T
Threemile
Run
Kinzua
Creek
Murrin
Creek
BALTIMORE AND OHIO
Gaffney
Kushequa
Kasson
6
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
0.5

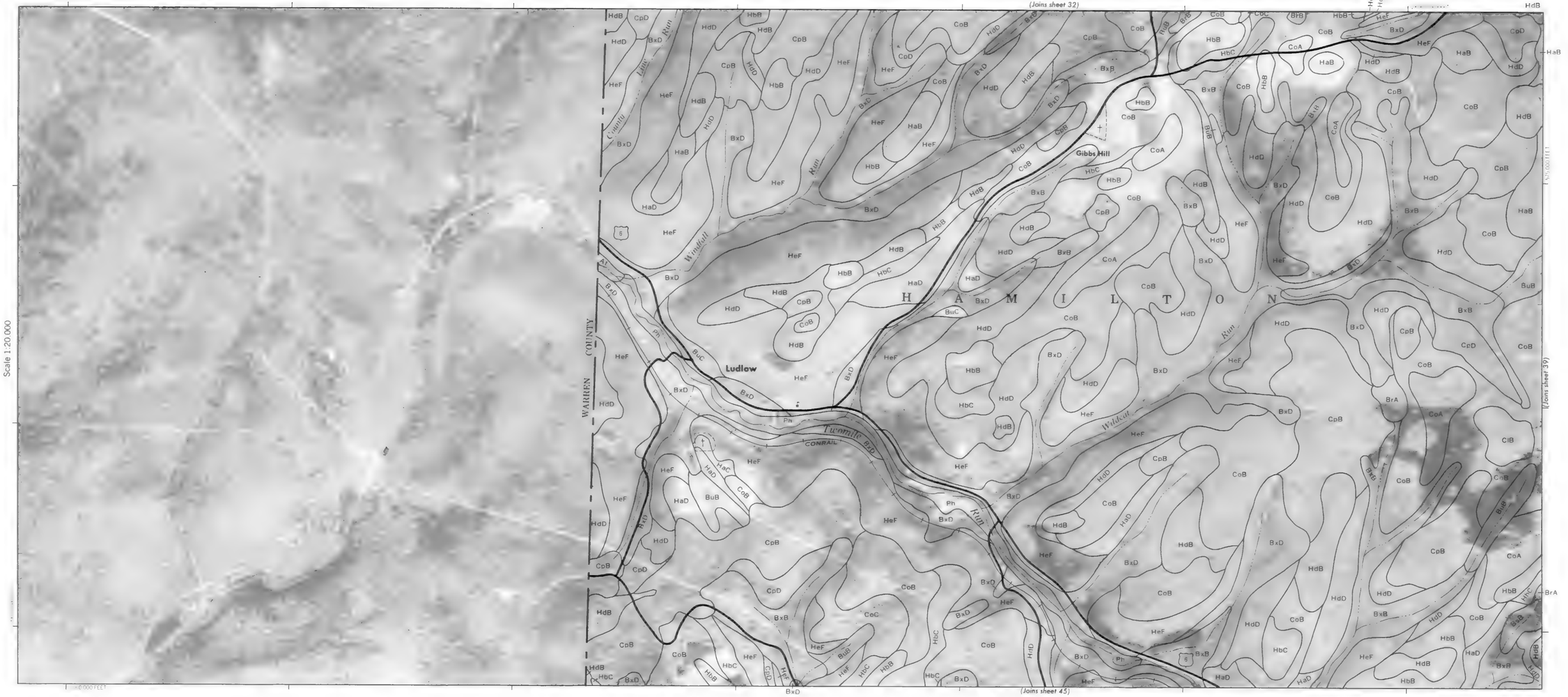

36
N
1 MILE
1 KILOMETER
Scale 1:20,000
(Joins sheet 29)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 42)
1 825 000 FEET
1 800 000 FEET
KEATING
SERGEANT
NORWICH
Irons Hollow
Irish Hollow
Burbank
Potato Creek
Bryer Brook
White Hollow



N

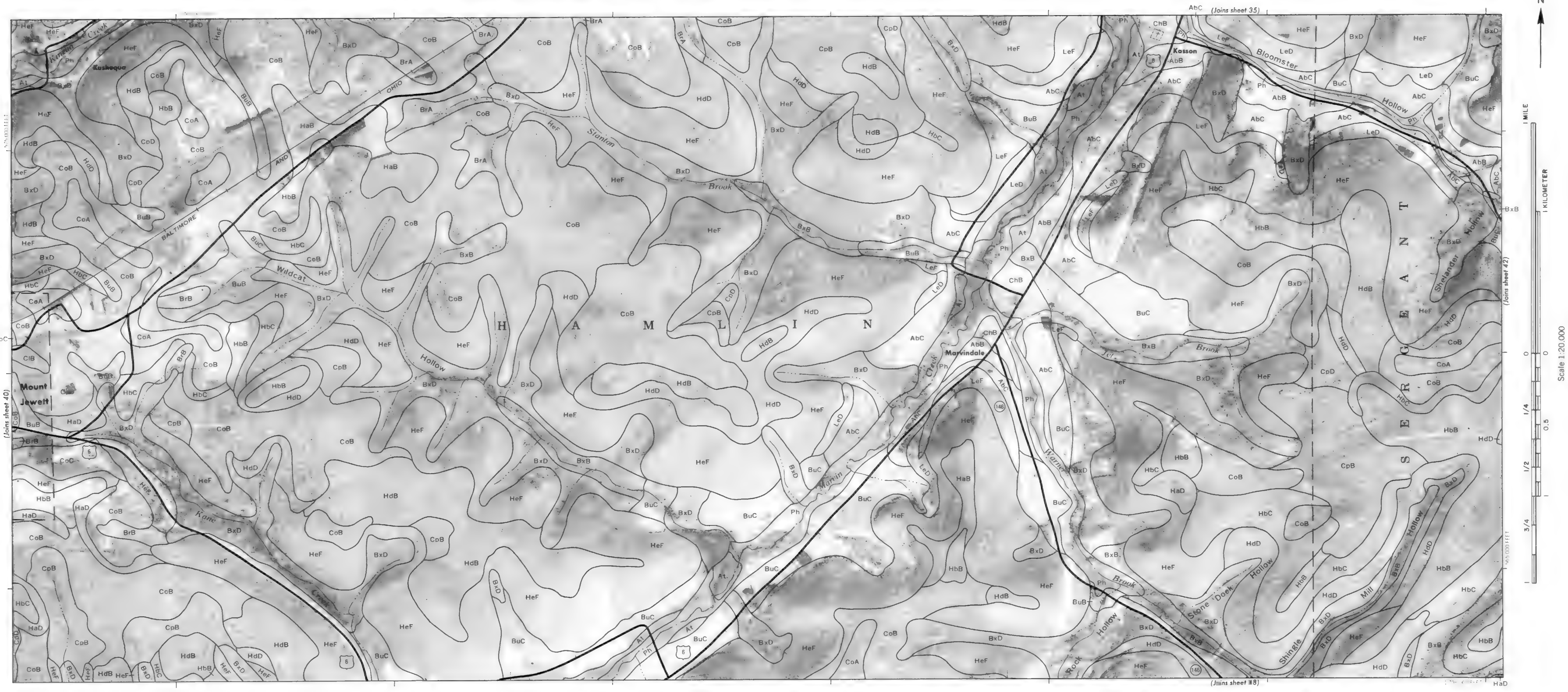
1 MILE
1 KILOMETER
0
0
1/4
0.5
1/2
1
3/4

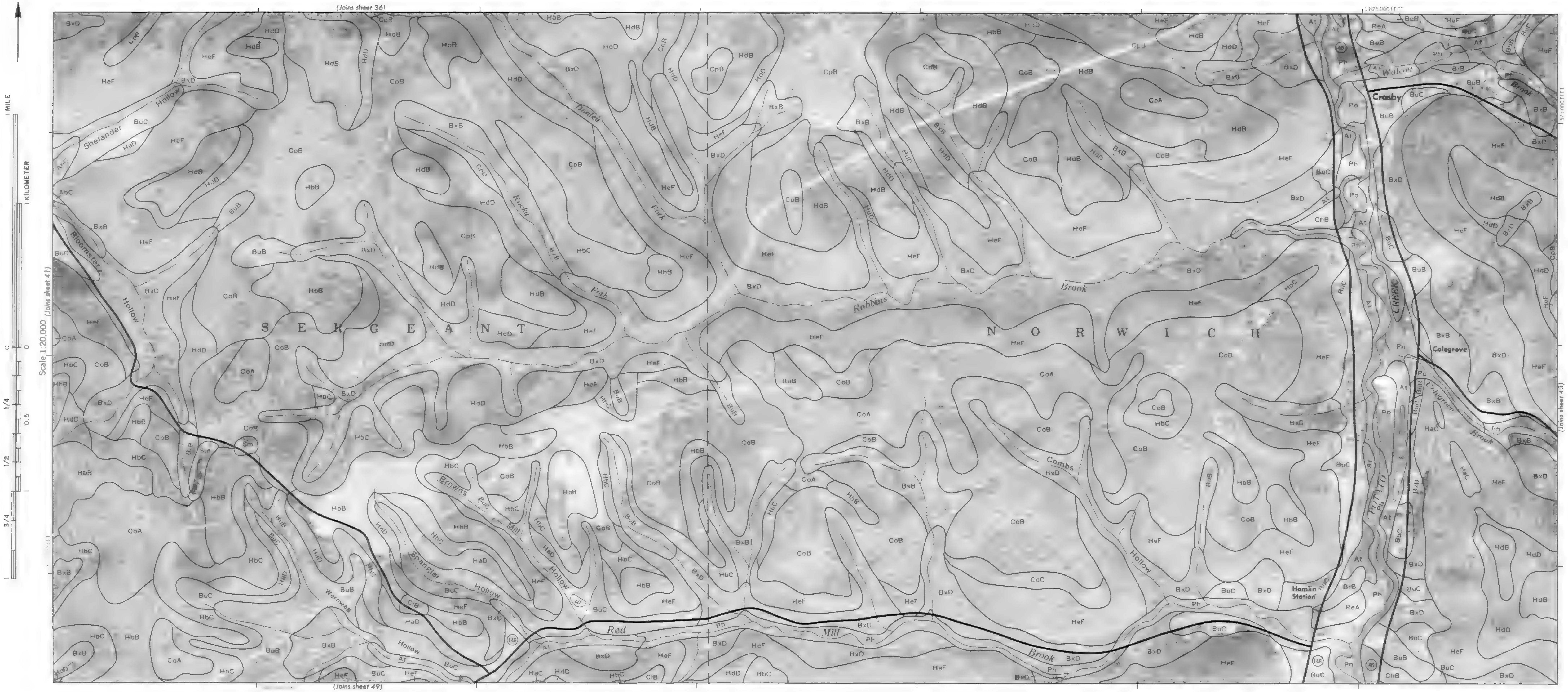
Scale 1:20,000

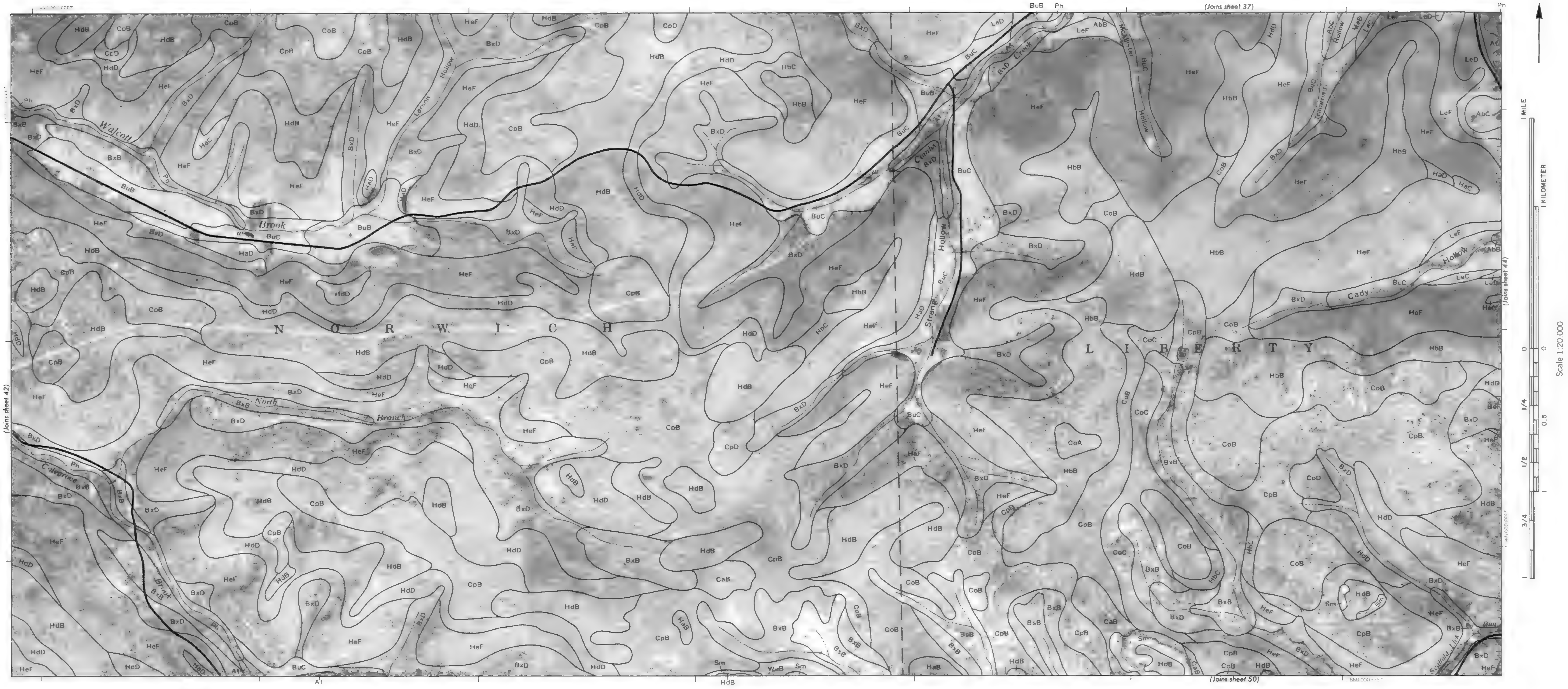

N
1 MILE
1 KILOMETER
Scale 1:20,000
(Joins sheet 32)
(Joins sheet 39)
(Joins sheet 45)
WARREN COUNTY
HAMILTON
Ludlow
Gibbs Hill
Twomile Run
Windfall Run
Wildcat Run
CONRAIL

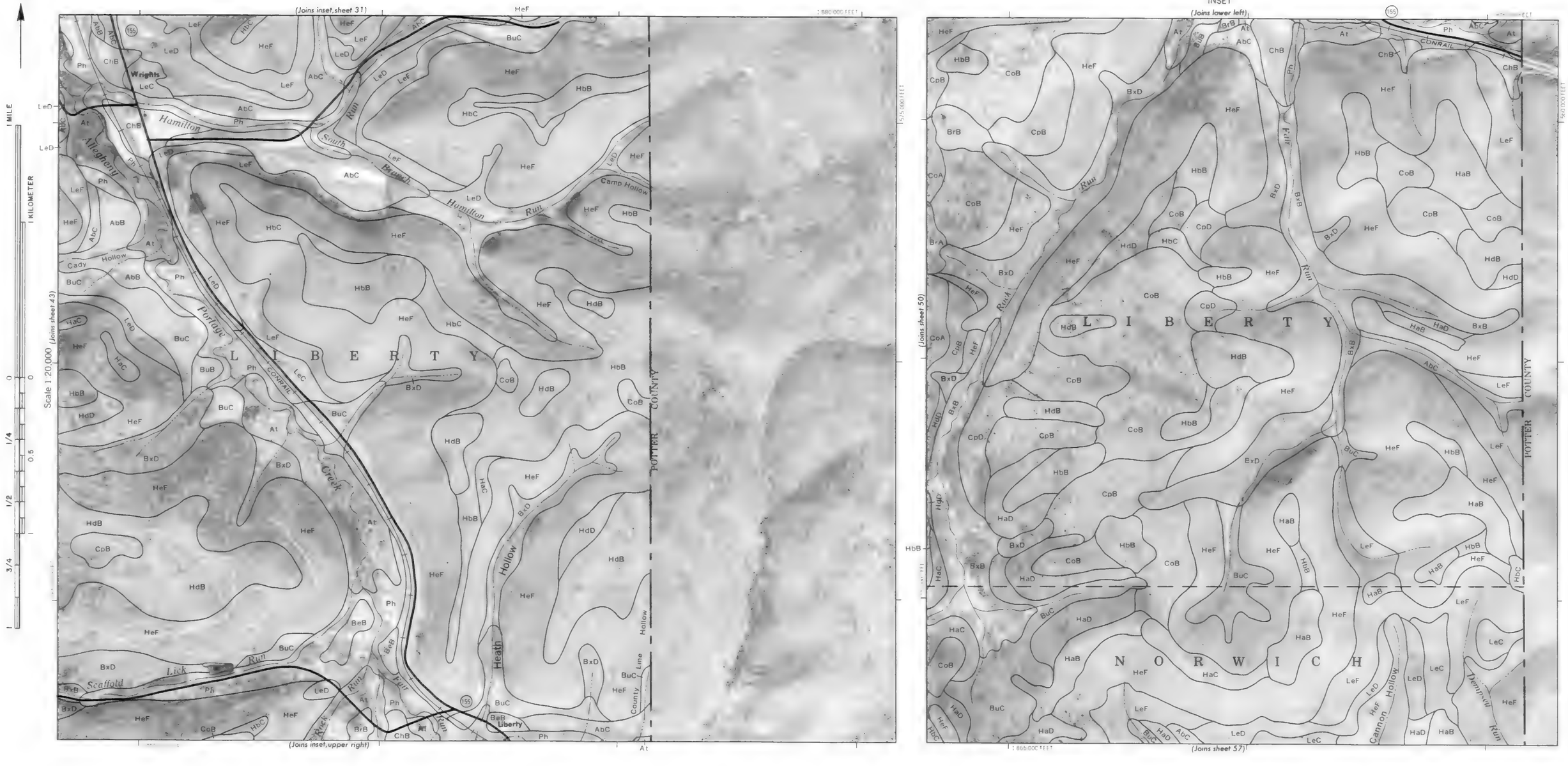

N
(Joins sheet 33)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 46)
WETMORE
HAMILTON
HAMILTON
Run
South Branch
Kinzua Creek
Bluchanake Run
Muddy Run
Mudlick Run
1 MILE
1 KILOMETER
Scale 1:20,000

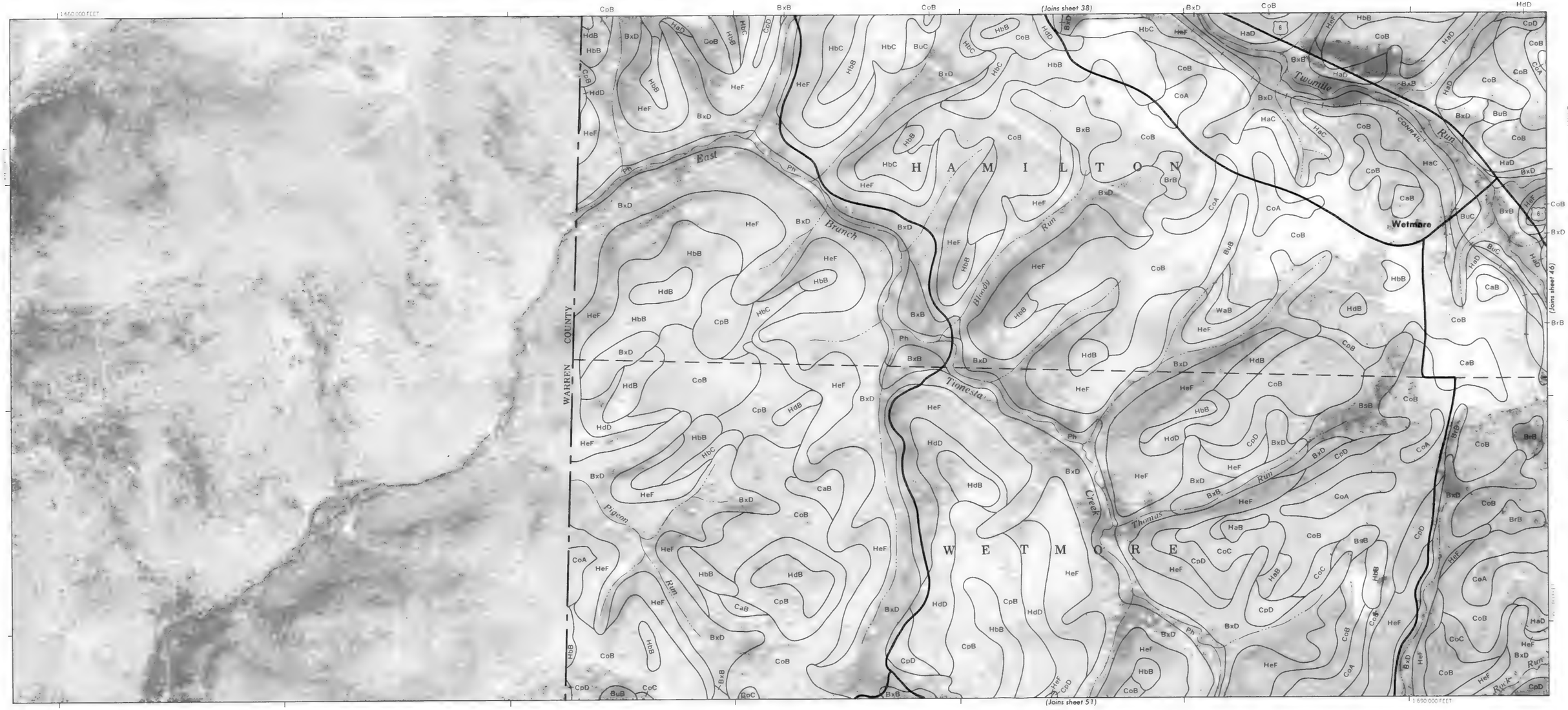

40
N
(Joins sheet 34)
(Joins sheet 39)
(Joins sheet 47)
(Joins sheet 41)
Scale 1:20,000
1 MILE
1 KILOMETER
0
1/4
1/2
3/4
0.5
HAMLIN
Windfall Run
Middle Run
South Branch Kinzua Creek
KINZUA CREEK
BALTIMORE AND
Mount Jewett
Campbelltown
Lantz Corners


N
(Joins sheet 35)
(Joins sheet 40)
(Joins sheet 42)
(Joins sheet 48)
H A M L I N
S E R G E A N T
Mount Jewett
Kushequa
Kasson
Marvindale
Kinzua Creek
BALTIMORE AND OHIO
Wildcat Hollow
Stanton Brook
Kane Creek
Marvin Creek
Bloomster Hollow
Shelander Hollow
Warner Brook
Stone Dock Hollow
Shingle Mill Hollow
Rock Hollow
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
0.5


N
1 MILE
1 KILOMETER
Scale 1:20 000
(Joins sheet 36)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 49)
S E R G E A N T
N O R W I C H
Shelander Hollow
Bloomster Hollow
Donley Fork
Rocky Fork
Robbins Brook
Browns Mill Hollow
Spangler Hollow
Wernwag Hollow
Red Mill Brook
Combs Hollow
Walcott Brook
Colegrove Brook
POTATO CREEK
Crosby
Colegrove
Hamlin Station
146
46


(Joins sheet 37)
(Joins sheet 42)
(Joins sheet 44)
(Joins sheet 50)
N O R W I C H
L I B E R T Y
Walcott Brook
North Branch
Colegrove Brook
Larson Hollow
Combs Creek
Strang Hollow
McAllister Hollow
Cady Hollow
N
1 MILE
1 KILOMETER
Scale 1:20 000
0
1/4
1/2
3/4
0.5


44
N
INSET
(Joins lower left)
(Joins inset, sheet 31)
(Joins inset, upper right)
(Joins sheet 43)
(Joins sheet 50)
(Joins sheet 57)
Scale 1:20,000
1 MILE
1 KILOMETER
L I B E R T Y
N O R W I C H
McKEAN COUNTY
POTTER COUNTY
Wrights
Hamilton
Allegheny
Portage
Camp Hollow
Cady Hollow
Scaffold Lick Run
Heath Hollow
Cannon Hollow
Liberty
CONRAIL
Ph
At
ChB
LeD
LeC
LeF
HeF
HbB
HbC
HdB
HdD
CoB
CpB
CpD
BxD
BuC
AbC
AbB
HaB
HaC
HaD
BeB
BrB
BrA
CoA



45

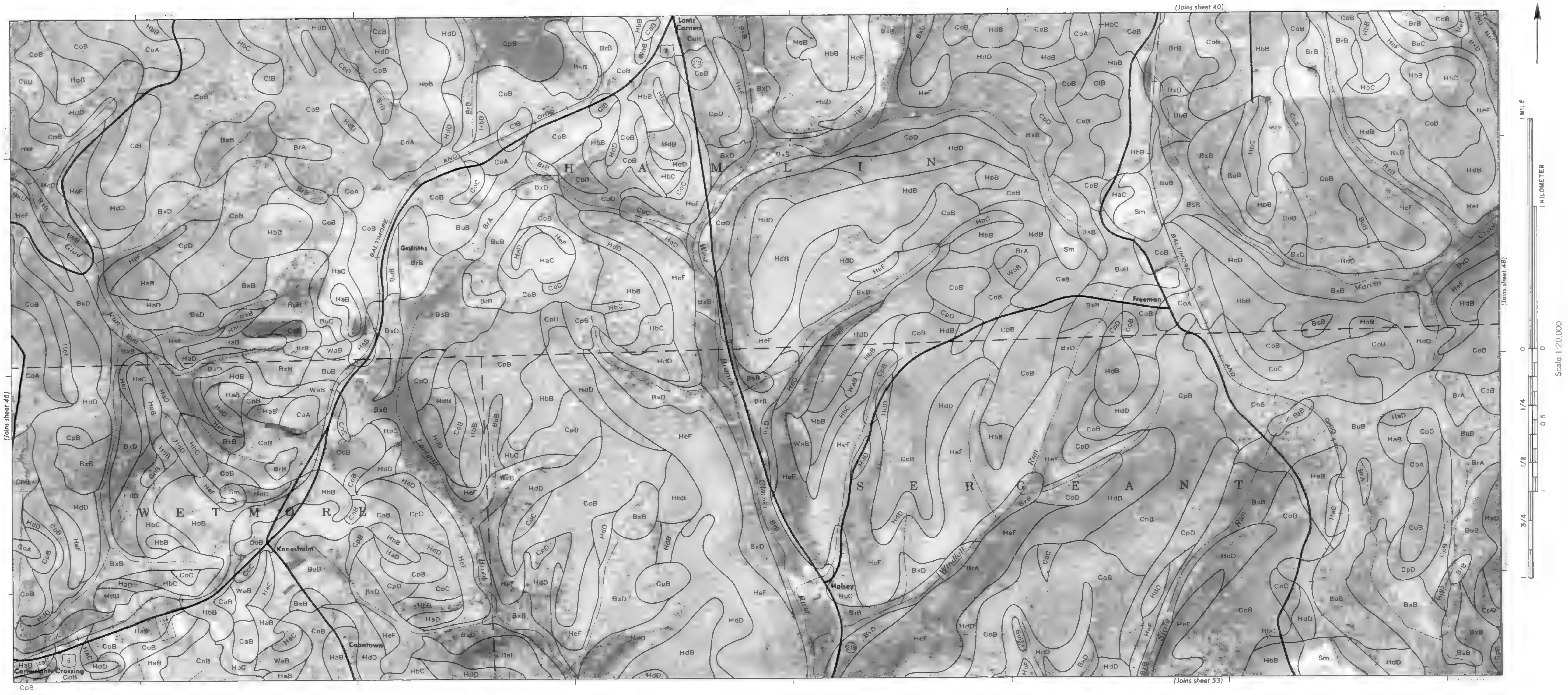
N

1 MILE

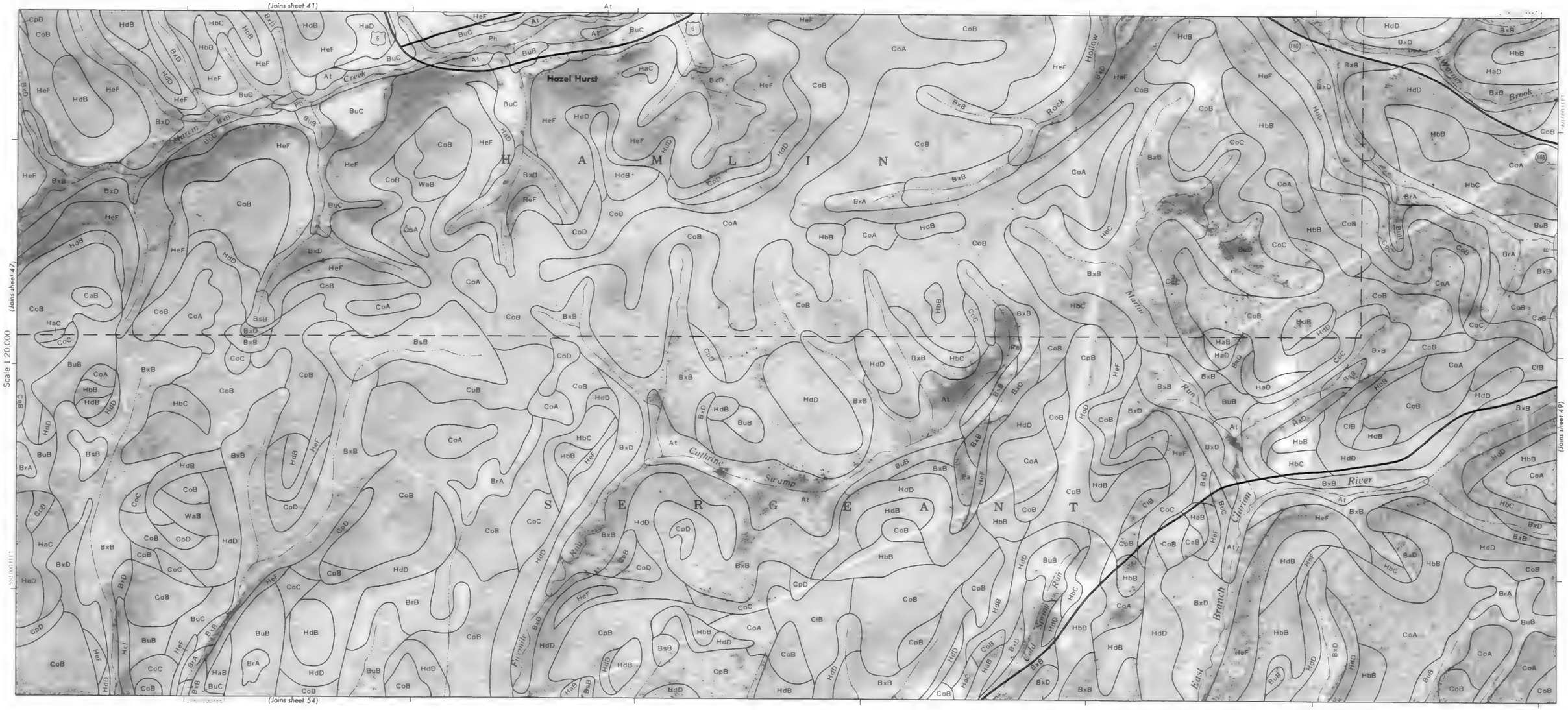
1 KILOMETER

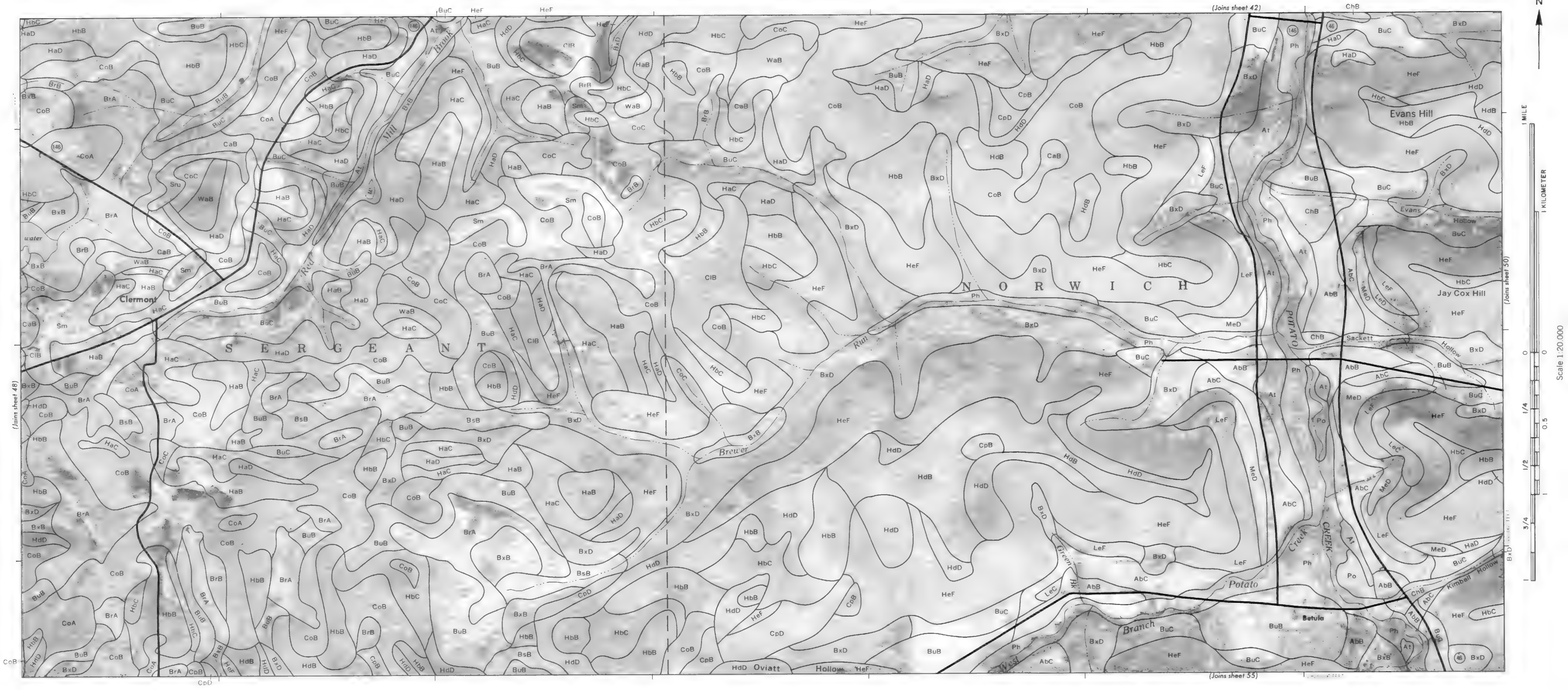
Scale 1:20 000


46
N
1 MILE
1 KILOMETER
Scale 1:20,000
1 725 000 FEET
(Joins sheet 39)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 52)
HAMILTON
WETMORE
HAMLIN
KANE
Preston
Wetmore
Tuwomile Run
Thwomile Run
Hubert Run
Watermill Run
South Branch Kinzua Creek
Glad Run
CONRAIL
BALTIMORE AND OHIO

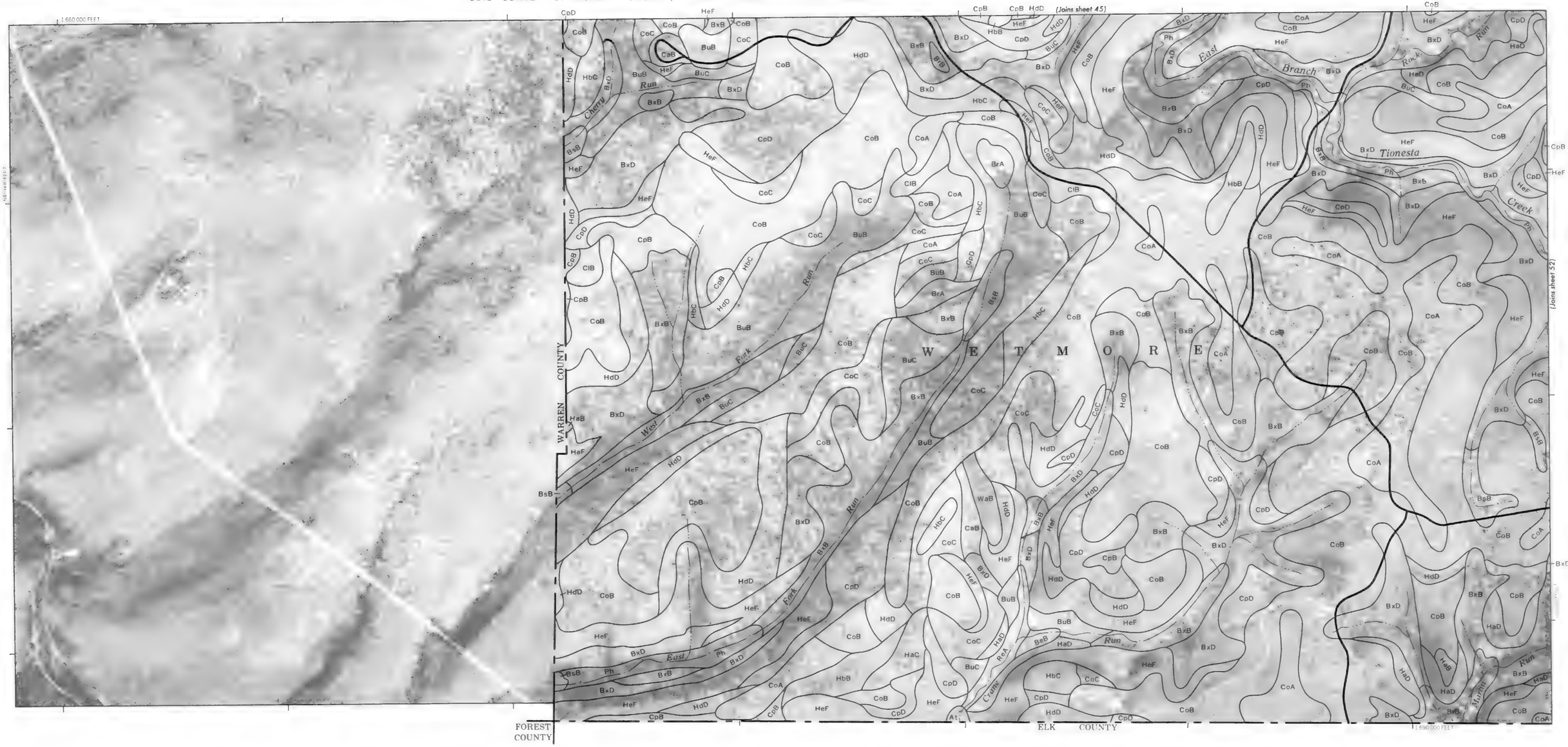

(Joins sheet 40)
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 53)
Lantz Corners
Griffiths
Freeman
Kanesholm
Halsey
Coontown
Cartwright Crossing
H A M L I N
W E T M O R E
S E R G E A N T
BALTIMORE AND OHIO
West Branch
Clarion River
Windfall Run
Marvin Creek
N
1 MILE
1 KILOMETER
Scale 1:20 000

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 48

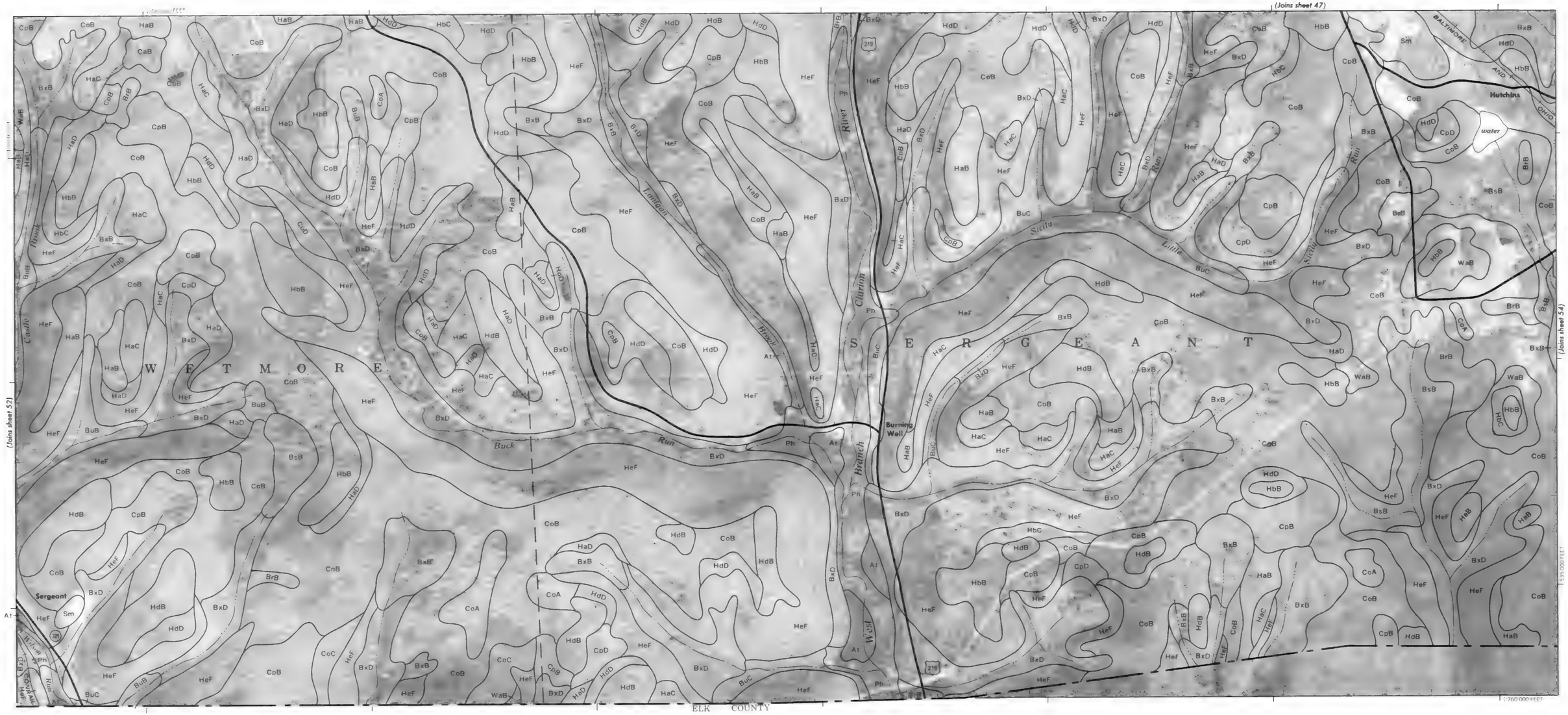



(Joins sheet 42)
(Joins sheet 48)
(Joins sheet 50)
(Joins sheet 55)
N
1 MILE
1 KILOMETER
Scale 1:20 000
SERGEANT
NORWICH
Clermont
Evans Hill
Jay Cox Hill
Evans Hollow
Sackett Hollow
Kimball Hollow
Oviatt Hollow
Betula
Potato Creek
Brewer Run
Mill Brook
Red Mill Brook
West Branch
Green Bk

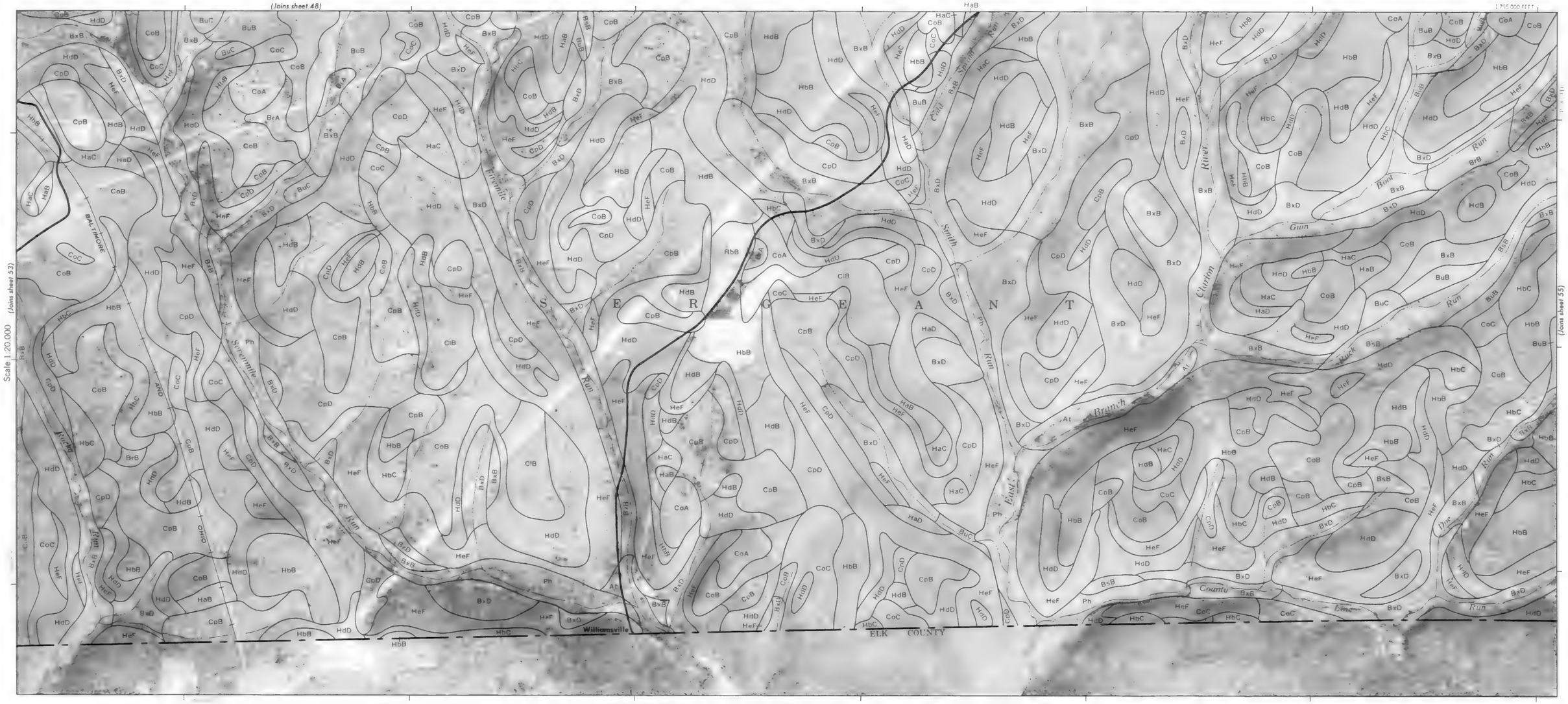

50
N
1 MILE
1 KILOMETER
Scale 1:20,000
(Joins sheet 43)
(Joins sheet 49)
(Joins sheet 56)
(Joins inset, sheet 44)
Evans Hill
NORWICH
LIBERTY
Hollow
Sackett
Kimball
Keesler
Saltzer
Taylor
Field
Branch
Evans
Scaffold
Lick
Run
Panther
Railroad
O'Brien
BxD
HeF
HdB
HdD
CoB
CoC
CpB
HbB
HbC
HaB
HaC
WaB
Sm
BsB
BuB
BuC
BrA
CaA
CaB

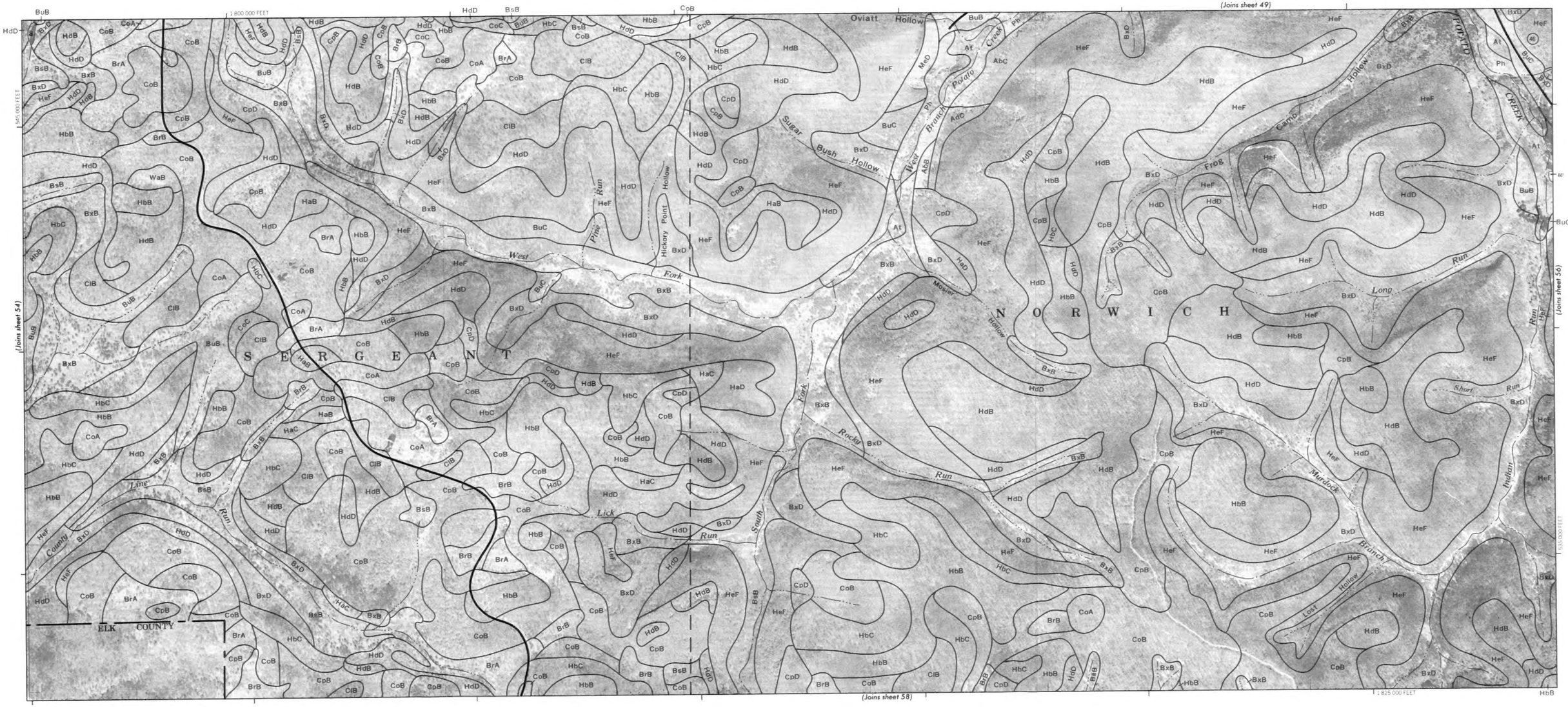

1 660 000 FEET
(Joins sheet 45)
(Joins sheet 52)
WARREN COUNTY
FOREST COUNTY
ELK COUNTY
WETMORE
Cherry Run
West Fork
East Fork
East Branch
Tionesta Creek
Rock Run
Hurtha Run
Crane Run
1 660 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:20 000

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 52

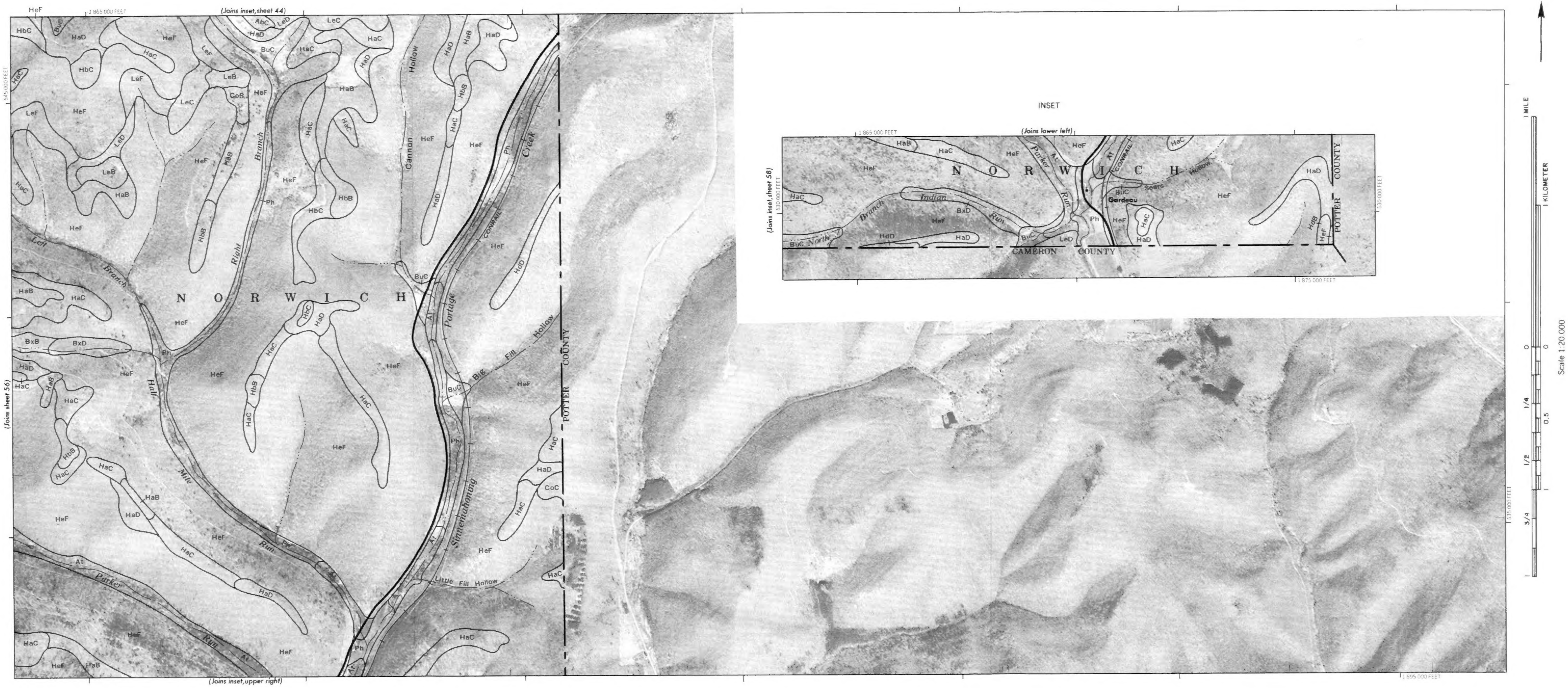

(Joins sheet 47)
(Joins sheet 52)
(Joins sheet 54)
WETMORE
SERGEANT
Castle Brook
Buck Run
Lamtown Branch
Clarion River
Little Sicily Run
Sicily Run
Burning Well
Hutchins
Sergeant
Hollow
Run
BALTIMORE AND OHIO
water
ELK COUNTY
1 MILE
1 KILOMETER
Scale 1:20,000
1:760,000 FEET

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 54




S E R G E A N T
N O R W I C H
ELK COUNTY
Oviatt Hollow
Sugar Bush Hollow
West Branch Potato Creek
Pine Run
Hickory Point
West Fork
Rocky Fork
Mosier Hollow
Line Run
County Line
South Lick Run
Frog Camp Hollow
Long Run
Short Run
Murdock Indian Branch
Lost Hollow
(Joins sheet 49)
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 58)
1 800 000 FEET
1 825 000 FEET
1 545 000 FEET
1 535 000 FEET
1 MILE
1 KILOMETER
Scale 1:20 000
N

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 56


(Joins inset, sheet 44)
(Joins sheet 56)
(Joins inset, upper right)
1 865 000 FEET
1 895 000 FEET
N O R W I C H
POTTER COUNTY
Left Branch
Right Branch
Hall Mile Run
Parker Run
Cannon Hollow
Portage Creek
Big Fill Hollow
Little Fill Hollow
Sinnemahoning
CONRAIL
INSET
(Joins lower left)
(Joins inset, sheet 58)
North Branch Indian Run
Parker Run
Sears Hollow
Gardeau
CAMERON COUNTY
POTTER COUNTY
1 875 000 FEET
N
1 MILE
1 KILOMETER
Scale 1:20 000

SOIL SURVEY OF McKEAN COUNTY, PENNSYLVANIA — SHEET NUMBER 58